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ORIGINAL PAPER

Local inequality and own rank preferences

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Abstract

We report a lab experiment to study subjects' preferences over their ordinal rank in an earnings distribution. Following an assignment of unequal earnings, subjects can select a monetary transfer from exactly one individual to another, not including themselves. This can potentially change their own position in the distribution, as well as influence overall inequality. The experiment varies whether the initial earnings assignment is random or is affected by preliminary competition. It also varies the reference group from a complete to a partial network. A majority of observed transfers reduce inequality by moving earnings from those with the highest rank to the lowest rank in the distribution. Rank-improving transfers are substantially more common for preliminary competition losers than winners. Transfers to individuals outside of the reference group are not uncommon, and they usually target as the source the individuals high in the income distribution. While generally weak overall, own rank preferences appear to be more common among men than women.

Keywords: Distributive preferences; inequality aversion; relative earnings; social preferences

JEL Codes: C90; D31; D91

> "Everyone in the town was an underdog in the carefully calibrated class structure of America — not for them the fancy private schools and university educations, unless they got really, really lucky — but there are no dogs so under that they don't welcome another dog even lower in the social scheme, to be made use of as a blank screen onto which all the things they dislike about their own positions may be projected." – Margaret Atwood (2024)

1. Introduction

People derive utility from consumption, but utility for many individuals may depend also on how their own status compares with thats of others'. That is, well-being may depend on an individual's relative position within a reference group, in addition to absolute consumption, income or wealth. While such relative, social preferences have been well documented, both through representative surveys and controlled experiments, it is unclear whether people care mostly about how their position compares to a reference point (such as mean income) or rather their position in a relative ranking. To provide direct evidence on rank preferences, this paper presents a laboratory experiment in which individuals can transfer earnings between others to change their own ranking in the distribution.

One challenge of distinguishing rank preferences from relative earnings preferences in the field is that an individual's ranked position in a distribution is naturally correlated with their earnings

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compared to a mean or some other reference. Boyce et al. (2010) provide survey evidence consistent with the *rank-income hypothesis*, that "people gain utility from occupying a higher ranked position within an income distribution rather than from either absolute income or their position relative to a reference wage" (p. 471). Other survey studies (Clark et al., 2009, Hvidberg et al., 2023, Xu et al., 2023) also document the importance of perceived ranking in determining well-being. While such surveys are valuable, they rely on self-reported and subjective measures of well-being; moreover, it is difficult to draw clear conclusions regarding relative satisfaction using ordinal responses (Bond & Lang, 2019). The experiment reported here instead uses a revealed preference approach for a direct measurement of rank preferences. We implement only one individual's choice at the session conclusion, holding constant the decision-maker's own earnings and the group's mean earnings. Fixing individuals' relative earnings thus isolates the expression of rank preferences.

In observational data it would be unusual to find a situation where people have the capability to transfer resources among others directly and potentially change their own ranking in a distribution. This is a particularly valuable characteristic of controlled experiments – the ability to create an artificial counterfactual. We find that subjects transfer money between others very frequently (about 90% of the time), and most transfers are large enough to change the earnings ranking, when possible. A large fraction of transfers focus on reducing the overall earnings inequality of the group, however, rather than being targeted to improve a subject's own position in the earnings distribution. This is especially common when the initial earnings distribution is completely random. Rank preferences appear to be sensitive to earlier interactions and may be triggered by an emotional response, as pairwise play of a zero-sum game before earnings are distributed raises the frequency of own rank-improving transfers by about 50 percent.

It is important to understand distinct preferences over ranking, rather than simply preferences about relative income with respect to some reference point, since this can affect political support for certain types of redistributive policies (Kuziemko et al., 2014, Karadja et al., 2017, Balietti et al., 2023). For example, individuals who occupy low positions in the income distribution, but not the very lowest, may not favor redistribution to the poorest if that reduces their own position in the income ranking. Kuziemko et al. (2014) provide survey evidence that low (but above minimum) wage workers are more likely to oppose minimum wage increases. They interpret this as evidence for a particular type of rank preference – last place aversion – since increases in the minimum wage might worsen these low-wage individuals' ranking in the distribution. Rank preferences that trigger envy can also pose a significant constraint on other economic reforms, especially when influencing behavior among those low in the income distribution (Mui, 1995). Gangadharan et al. (2021) find in a lab experiment that prospects for income mobility reduce antisocial behavior – costly reductions in others' earnings. Understanding rank preferences is also important because relative performance evaluation is common in business, so it is important to understand how this motivates performance (Gill et al., 2019). For example, knowledge about relative ranking could lead to greater work effort. Rank preferences may also be natural from an evolutionary perspective. Animals may care about rank indirectly because it influences outcomes of direct concern, such as access to food and good mates.

The experimental design is detailed in Section 2. After learning a (randomly-determined) distribution of experimental earnings, ranging from $6 to $20, subjects have an opportunity to transfer money from one individual to another. They cannot change their own earnings. They make this transfer decision across many rounds, with stationary repetition except for new random variation in the earnings distribution across rounds. At the end of their session, one individual's choice is randomly selected for one round and implemented for payment. In half the rounds the (discrete) set of available transfers includes amounts large enough to change the ranking of individual earnings. The experiment includes a pre-transfer competition treatment to determine earnings and also varies between subjects the social proximity of the reference group – i.e., the subjects whose earnings are observed when choosing transfers. Previous studies, including Hvidberg et al. 2023 and Xu et al. (2023), have found

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that inequalities are considered more unfair, and relative income has a greater impact on income-related satisfaction within narrower comparison groups (age, education, occupation) than broader, national comparisons.

The theoretical framework presented in Section 3 extends the seminal Fehr and Schmidt (1999) model of inequality aversion to include a potential rank-based disutility. In the model, some individuals may suffer disutility from being in a lower position in the distribution, in addition to the standard disutility they may experience from earnings inequality. We also posit that this additional rank-based disutility may be greater for those in lower ranked positions in the earnings distribution, but the pattern of transfers observed in the experiment is inconsistent with this assumption.

A large literature has documented the importance of income inequality on perceived well-being, especially using survey methods; Clark and D'Ambrosio (2015) provides a review. Some experiments have allowed outsiders to redistribute earnings among others. Fischbacher et al. (2023) find that individuals favor natural in-groups defined by political orientation or nationality, Charité et al. (2022) study redistributive preferences when others may or may not know their initial endowments, and Almas et al. (2020) find that Americans are more accepting of inequality than Norwegians. These studies do not consider redistribution that can change the decision-maker's own ranking. Previous experimental studies investigating own rank preferences include Gill et al. (2019), which reports a real effort competition and documents a strong aversion to the lowest rank and preference to achieve the highest rank. Clark et al. 2010 finds that an "individual's". rank in the income distribution has a greater influence on (chosen, not real) effort than does others' average income.[1] Martinangeli & Windsteiger (2021) document a general dislike for rank reversals, affecting most ranks, which is also seen in the lab experiment of Xie et al. (2017). By contrast, our subjects are not reluctant to change others' ranks when possible, and the pattern of their chosen monetary transfers usually reduces income inequality within their group.

2. Experimental design

Subjects were placed into fixed groups of size $n = 8$, with two or three groups simultaneously in the lab (16 or 24 subjects). They received randomly shuffled earnings each round, in order to collect preferences for every individual in every possible position in the earnings ranking. After learning their own earnings and ranking in each round, all subjects could choose an earnings reallocation among others in their group. This was restricted to a single transfer of an amount from a limited set, rather than a multitude of transfers that could shuffle others' earnings (somewhat) arbitrarily. Subjects could not transfer funds to or from themselves. One of the eight subjects' transfer was selected at random from one round to be implemented at the end of their session.[2] A transfer of zero, to leave the earnings distribution unchanged, was always in the choice set.

Table 1 displays the pre-transfer earnings distribution **x**. The experiment varied the set of possible transfers T within subjects, with 30 rounds of T_1 followed by 30 rounds of T_2 in half the sessions; the other half reversed this ordering. Note that both transfer sets avoid whole numbers that could lead to post-transfer "ties" in earnings. This is mainly to simplify the exposition of the rank preferences model in the next section. Only the transfer set T_2 includes amounts greater than \$2 to allow subjects to change the ranking of the earnings distribution. Although subjects' transfers could not affect

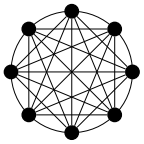
[1]Kuziemko et al. (2014) also included a laboratory experiment to document individuals' aversion to ranking lowest in the earnings distribution. They find that the individual in the second-lowest rank is less likely to transfer earnings to the individual below themselves to avoid moving to the lowest rank. This result fails to replicate, however (Martinangeli and Windsteiger, 2021, Camerer, 2016).

[2]It is possible that the random shuffling of ranks each round reduced positional concerns, leading some subjects to focus on "fairness" and making transfers to reduce overall inequality. This is mitigated somewhat, however, by the selection of a single round and a single subject's transfer choice to be implemented at the end of the session. Payments are based on a choice in a specific rank and not an average rank.

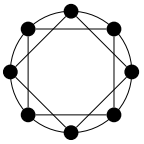
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Table 1. Experimental Design

Earnings distribution $\mathbf{x} = \{\$6, 8, 10, 12, 14, 16, 18, 20\}$ (Earnings reset every round)	Pre-competition distribution $\mathbf{x_0} = \{\$7, 7, 11, 11, 15, 15, 19, 19\}$ (Earnings reset every round)
Possible Transfer Sets	
$T_1 = \{\$0, 0.45, 0.90, 1.35, 1.80\}$	$T_2 = \{\$0, 0.45, 0.90, 1.35, 1.80, 2.25, 2.70, 3.15, 3.60\}$
Treatments	Subjects (Groups)
Global	64 (8)
Local	64 (8)
Competition	64 (8)



COMPLETE $(degree = 7)$ - 'Global'



LOCAL INTERACTION $(degree = 4)$ - 'Local'

Fig. 1 Network connections. (a) Complete (*degree* = 7) - 'Global' (b) Local Interaction (*degree* = 4) - 'Local'

their own *earnings*, with transfer set T_2 subjects could change their own *ranking* in the earnings distribution.[3]

The experiment varied the reference group (network structure) between sessions. In the **Global** treatment the network was complete so that subjects could observe the earnings of all seven others in their group (Figure 1). The **Local** treatment reduced the reference group to four other subjects, and an "out-group" of three subjects were displayed on decision screens with no indicated earnings amount.[4] Instead, the individual earnings for these three "out-group" subjects were indicated by question marks, as illustrated in Appendix B Figure 9. The set of connected subjects varied randomly each round, and subjects received no information about others (other than their random initial earnings) in any treatment. Subjects could nevertheless transfer money to or from these out-group members who were not in their local network. Appendix A illustrates the other transfer decision screens used in the subject instructions.

The **Competition** treatment also employed a complete, global network, but it included a pre-transfer competition stage that determined subjects' position in the earnings distribution **x**. Subjects' initial earnings were randomly distributed as shown in the vector $\mathbf{x_0}$ in Table 1. They then played a zero-sum, matching pennies game with the individual who was endowed with the same amount. The loser paid the winner \$1, which resulted in the same pre-transfer earnings distribution **x** used in the other treatments. Since the outcome of the competition was completely random, the pre-transfer distribution was also random as in the **Global** and **Local** treatments and so it can be regarded

[3]For example, an individual with earnings of \$12 could transfer \$3.60 from the subject immediately above themselves who holds initial earnings of \$14 to the "poorest" individual initially holding \$6. This raises the ranking of the subject initiating the transfer from fifth highest to fourth highest because their target would then have only \$14-3.60=\$10.40, less than their own \$12. It also raises the rank of the transfer recipient, whose new \$6+3.60=\$9.60 earnings exceeds the second-lowest (now the very lowest) individual with \$8.

[4]Thus, by displaying different earnings each round, the background earnings distribution changed randomly (Seidl et al., 2006). Sometimes some subjects did not view earnings of those immediately above or below themselves in the distribution, which limited their ability to make transfers to change their own rank.

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as exogenous.[5] In all treatments the different random initial payoffs drawn from $\mathbf{x}$ or $\mathbf{x_0}$ generate variation in individuals' ranking.

All sessions were conducted at the Vernon Smith Experimental Economics Laboratory at Purdue University, with experimental software implemented using oTree (Chen et al., 2016). The 192 subjects were undergraduate students, recruited across different disciplines at the university by email using ORSEE (Greiner, 2015). No subject participated in more than one session. Subjects never received feedback about others' choices during their session, so we treat individuals as independent in the statistical analysis.

At the beginning of each session subjects read the instructions shown in Appendix A on their computers, and these were also displayed on a projector in the lab to promote common knowledge that everyone faced the exact same decision environment. One round was selected at the end of the session, and one subject's transfer decision for that round was implemented for payment in each group. Subjects also completed a short Social Value Orientation task at the conclusion of the experiment, implemented with 6 allocation choices (Murphy et al., 2011), with one choice in each pair randomly drawn for payment (see Part 2 in the instructions Appendix A). We collected this independent measure of social preferences to determine whether different preference types (e.g., prosocial compared to individualistic) chose different types of transfers. Subjects earned $21.73 on average, including a $5 show-up fee, and sessions lasted about 60 (90) minutes without (with) pre-transfer competition.

3. Theoretical framework

We consider an environment with n agents, indexed by $i \in \{1, 2, \dots, n\}$, and a set of initial monetary holdings $\mathbf{x} = \{x_1, x_2, \dots, x_n\}$, with $x_1 \leq x_2 \leq \cdots \leq x_n$ so that an agent's index corresponds with their relative position in the monetary distribution. Further, we assume that individuals are connected through a network, which we denote by its corresponding adjacency matrix $\mathbf{g}$, that is binary and symmetric with $g_{ij} = g_{ji} = 1$ if distinct agents i and j are linked; $g_{ij} = g_{ji} = 0$ otherwise. The neighborhood of each individual i is defined as $N_i(\mathbf{g}) = \{j \mid g_{ij} = 1\}$ and describes the set of individuals with whom i shares a link in the network. We use the neighborhood of individual i to describe their reference group (i.e., the set of individuals whose monetary payoffs enter their utility function), and their degree, denoted by $d_i(\mathbf{g}) = |N_i(\mathbf{g})|$, to capture the size of this group.[6]

Following Fehr and Schmidt (1999), we consider inequality-averse individuals, but we extend their framework in two ways. First, Fehr and Schmidt (1999, p. 821) state that "the determination of the relevant reference group and the relevant reference outcome for a given class of individuals is ultimately an empirical question. The social context, the saliency of particular agents, and the social proximity among individuals are all likely to influence reference groups and outcomes." In our framework, the social proximity (or saliency) of others is explicitly defined by the network structure.[7] Second, in addition to own monetary payoffs and inequality, we posit that individuals' utility may be affected by their relative monetary ranking within their reference group. We define $\mathbf{x}_i = \{x_i\} \cup \{x_j \mid j \in N_i(\mathbf{g})\}$ to be the set of monetary holdings of agent i and each of their network neighbors and let $r(x_i, \mathbf{x}_i) \in \{1, \dots, d_i + 1\}$ denote the rank of individual i within their reference group.

[5]Thus, all of our treatments involve procedural justice, in that subjects all had equal ex ante opportunity and pre-transfer earnings were determined solely by luck. The Competition treatment, however, gives the illusion of agency since earnings were influenced by choice (Akbas et al., 2019).

[6]Throughout, we assume that $d_i(\mathbf{g}) \geq 1$ for all i so that each agent has a non-empty reference group.

[7]We maintain their assumption that the reference (equitable) outcome is the egalitarian one, over the subset of agents that form an individual's reference group.

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Then, the utility function of agent $i \in \{1, 2, \dots, n\}$ is given by

$$U_i(\mathbf{x}; \mathbf{g}) = x_i - \frac{\alpha_i}{d_i} \sum_{j \neq i} g_{ij} \max\{x_j - x_i, 0\} - \frac{\beta_i}{d_i} \sum_{j \neq i} g_{ij} \max\{x_i - x_j, 0\} - \gamma_i f(r(x_i, \mathbf{x}_i)),$$

where we assume that $\beta_i \leq \alpha_i$, $0 \leq \beta_i < 1$, and $\gamma_i \geq 0$. The second (third) term measures utility loss from disadvantageous (advantageous) inequality.[8] The fourth term captures potential rank-based disutility, with $f : \{1, \dots, d_i + 1\} \to \mathbb{R}$ describing the magnitude of disutility associated with each possible rank and γ_i represents the individual's sensitivity to rank-based utility loss. The $\gamma_i \geq 0$ restriction and non-negativity of f (see below) omits the possibility that individuals prefer to have a lower rank in the earnings distribution.[9]

We assume that f satisfies $f(r(x_i, \mathbf{x}_i)) > f(r(x_i, \mathbf{x}_i) + 1)$ and $f(d_i + 1) \geq 0$. This implies that those in lower ranks potentially incur an increasing disutility for occupying a lower rank in the distribution. However, these increasing penalties are only felt if the individual is sensitive to rank based disutility (i.e., if $\gamma_i > 0$). Beyond this, we make no specific assumptions about what form the function f may take. As such, this specification is general enough to allow for phenomena demonstrated in existing experimental work, such as last-place aversion (Kuziemko et al., 2014), first-place loving and last-place loathing (Gill et al., 2019), and a dislike of disadvantageous rank reversals (Martinangeli and Windsteiger, 2021).

3.1. Monetary transfers

In the experiment each individual k can make a monetary transfer, $t_{\ell,m}$, from some individual ℓ to another individual m, such that $k \notin \{\ell, m\}$, where the transfer amount is selected from a set of available options, $T \subseteq \mathbb{R}_+$. Any such transfer will leave the monetary holdings of individual k unchanged. However, depending on the identities of the individuals involved in the transfer and the amount transferred, it may affect the levels of advantageous and disadvantageous inequality they experience and their relative ranking within their reference group. The optimal transfer for an individual will depend on their degree of inequality aversion and sensitivity to rank-based disutility.

The types of transfers an individual can implement depends on the information they observe; in particular, the structure of the network determines the size of their reference group. Individuals with a complete reference group ($d_i(\mathbf{g}) = n - 1$) can only impose transfers where both the source and recipient are members of their reference group; we refer to these as In-to-In transfers. However, an individual with a non-complete reference group ($d_i(\mathbf{g}) < n - 1$) may also implement transfers involving those outside of their reference group. There are three such types of transfers to consider: Out-to-In (source outside, recipient inside), In-to-Out (source inside, recipient outside), or Out-to-Out (source and recipient both outside).

3.2. Hypotheses

This section presents several hypotheses about the types of transfers that individuals will implement, based on their preferences. We first consider, as a baseline, a purely self-interested individual who cares only about their own monetary payoffs (i.e., $\alpha_i = \beta_i = \gamma_i = 0$). Such an individual is indifferent towards any amount of inequality, both advantageous and disadvantageous, and is also unconcerned with their relative rank within their reference group. Therefore, they should be indifferent between

[8] Fehr and Schmidt (1999) impose these same restrictions on α_i and β_i, which have empirical support in a wide range of decision environments.

[9] An alternative way of extending the Fehr-Schmidt model to incorporate rank preferences is to allow the disutility terms α_i and β_i to differ depending on the rank in the distribution (Fisman et al., 2021).

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all possible transfers, since none have an effect on the only component of their utility–their own monetary payoff.[10]

Hypothesis 1. (Non-social preferences: $\alpha_i = \beta_i = \gamma_i = 0$) *Individuals are indifferent between all transfers, including transfers of zero, so chosen transfers will not display any discernible pattern.*

We next consider an individual who is inequality averse ($\alpha_i \geq \beta_i > 0$) but not sensitive to rank-based utility ($\gamma_i = 0$). While purely self-interested individuals are indifferent between all possible transfers, inequality averse individuals will impose transfers that adhere to a pattern summarized in the following hypothesis. In general, they will choose transfers that reduce disadvantageous inequality, advantageous inequality, or both simultaneously. Specifically, In-to-In transfers should involve a source in a higher rank and a recipient in a lower rank, Out-to-In transfers should select a lower ranked individual in the reference group as the recipient of the transfer, and In-to-Out transfers should select a higher ranked individual in the reference group as the source of the transfer. The hypothesized In-to-In pattern follows directly from the stronger dislike of disadvantageous than advantageous inequality, $\alpha_i \geq \beta_i$. The hypothesized transfers involving members of the out-group follow from the assumption that these individuals are not in the subject's reference group, so changes in their earnings do not affect inequality aversion. But transfers to lower (from higher) ranked individuals of the in-group lower advantageous (disadvantageous) inequality. Finally, we note that any Out-to-Out transfer will leave utility unchanged, and therefore, should not be implemented.

Hypothesis 2. (Inequality aversion only: $\alpha_i \geq \beta_i > 0$, $\gamma_i = 0$)

(a) *Individuals choosing In-to-In transfers will transfer from those above themselves in the earnings distribution to those below themselves (whenever possible).*
(b) *Individuals choosing Out-to-In transfers are more likely to choose as the recipient of their transfer someone below themselves in the earnings distribution than those above.*
(c) *Individuals choosing In-to-Out transfers are more likely to choose as the source of their transfer someone above themselves in the earnings distribution than those below.*
(d) *Individuals will not implement Out-to-Out transfers.*

This hypothesis indicates that inequality aversion alone leads individuals who have a stronger disutility from disadvantageous inequality to target those in higher (lower) ranks as the source (recipient) of their transfers. Due to the linear functional form of the utility function, individuals are indifferent regarding the source and recipient of the transfer, as long as the source is in a higher rank and the recipient in a lower rank than themselves.[11] The amount of inequality they experience only depends on the absolute value of the difference in current monetary holdings, so a transfer from a higher ranked individual to someone in a lower rank increases their utility by an amount proportional to the size of the transfer regardless of the values of the initial monetary holdings (ranks) of the source and recipient.

In general, many source and recipient combinations could result in a decrease in aggregate inequality. However, if in addition to being inequality averse, individuals have preferences over their relative ranking ($\gamma_i > 0$), then they may be more particular about which others to target as the source and

[10] As an editor points out, this is not really a rejectable hypothesis since a selfish individual is indifferent among any potential transfers. The subsequent hypotheses imply transfers with specific patterns, however. An alternative design could add a small transfer cost, which would lead to a stronger prediction that selfish individuals would never make any transfers.

[11] Note that the self-centered and linear nature of this inequality aversion model implies that any transfer between subjects who are both above the subject in the earnings distribution leaves utility unchanged. Similarly, transfers between two subjects who are both lower in the distribution than the subject does not change utility. These types of transfers do not affect perceived inequality.

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recipient of their transfer. For example, if feasible transfers are sufficiently large, an individual may elect to target the person ranked just ahead of themselves as the source and change their relative ranking.[12]

Hypothesis 3. (Inequality aversion and rank disutility: $\alpha_i \geq \beta_i > 0$, $\gamma_i > 0$) *When individuals choose transfers large enough to change ranks, they are more likely to target as the transfer source the individual one rank above themselves than other ranks.*

Our final hypothesis concerns the propensity for individuals to target the person one rank above themselves as the transfer source. We have postulated that individuals incur increasing levels of disutility for occupying lower ranks in the distribution. If this is the case, individuals who are sensitive to rank-based disutility will more often impose rank-improving transfers, when possible, if they occupy a lower rank in the distribution.

Hypothesis 4. (Increasing rank disutility) *The propensity to target the individual one rank above as the transfer source is stronger for those who are lower in the earnings distribution.*

We conclude this section with a conjecture that rank-improving transfers will be more common following the pre-transfer competition stage employed in the Competition treatment. This pre-transfer competition may strengthen or prime rank preferences. It could also introduce emotions, and some losers may feel anger and seek revenge while some winners might feel sorry for the competition losers.[13] Previous experiments have shown that positive social interactions promote subsequent cooperative behavior, suggesting that this strengthens group identity and pro-social preferences (Cason et al., 2019). The opposite may be true for earlier negative interactions, such as a loss in the pre-transfer competition game. Regardless of the interpretation, in terms of the model this could be thought of as a change in the level of γ_i. This has implications for the pattern of transfer choices, as summarized in the following conjecture.

Conjecture 1. (Competition treatment) *Individuals are more likely to target as the transfer source the individual one rank above themselves than others after engaging in preliminary competition.*

4. Results

We present the experiment findings with a series of six key observations and results, immediately followed by their statistical support. The first concerns the size of the chosen transfers. We then report the sources and recipients of the transfers, and document the frequency of transfers to or from others outside subjects' local network. Finally, we compare the frequency of transfers that increase or decrease subjects' position in the earnings distribution, and particularly how this differs when pre-transfer competition determines earnings.

The first finding documents that subjects reveal a robust preference over relative earnings by frequently transferring amounts between others.

Observation 1. *Overall, about 90 percent of transfers are non-zero, and about one-half transfer the maximum possible amount. Maximum transfers are significantly less common in the transfer set T_2 that has a greater maximum.*

[12] Depending on the initial monetary distribution and set of available transfers, own rank improving transfers could target individuals more than one rank higher. The experiment, however, limited the maximum transfer to allow only changes by one rank position to focus on local own rank preferences.

[13] See Krawczyk (2010) and Mollerstrom et al. (2015) for other experiments in which a third party can redistribute earnings between others, determined through luck compared to effort.

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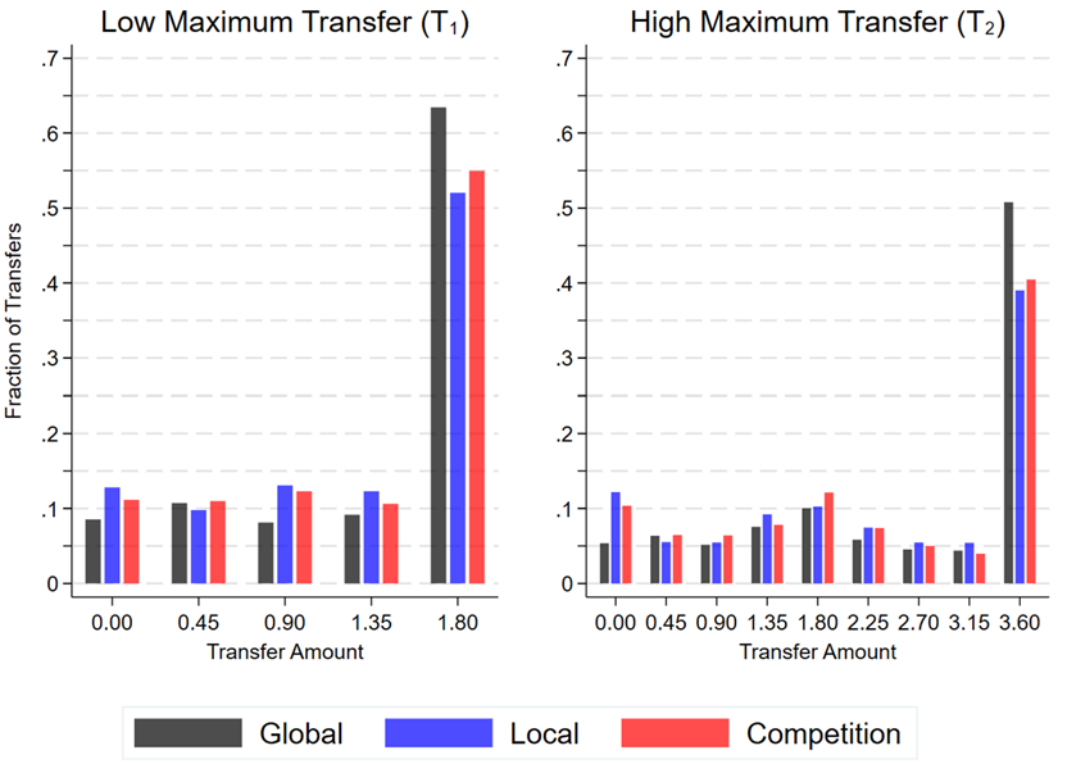


Fig. 2 Frequency distribution of transfer amounts

Support: Figure 2 displays a histogram of selected transfer amounts, distinguished by treatment. A total of 10,360 out of 11,520 transfers (89.9 percent) were positive. The most common transfer amount was the maximum possible – 56.8 percent of transfers were \$1.80 in the T_1 treatment, and 43.4 percent of transfers were \$3.60 in the T_2 treatment. The frequency of a zero transfer amount is marginally higher in the Local than Global treatment (p-value=0.054).[14] Maximum transfers are significantly more frequent in the low T_1 treatment than high T_2 treatment (p-value<0.001), although well more than half of the transfers in T_2 are greater than the maximum (\$1.80) transfer in T_1. Some individuals may avoid transfers greater than \$2 if they dislike changing the earnings ranking. Transfers are also marginally significantly greater in the Global than Local treatment (p-value=0.052).[15]

Having established that subjects in this environment readily transfer earnings between others, we next consider who they select as the source (or, "target") and recipient of the transfers, and how this affects inequality and the earnings ranking.

Observation 2. *In all treatments transfers most frequently target individuals with the highest earnings as the source, moving funds to individuals with the lowest earnings as the recipient. Such transfers are significantly less frequent in the Competition than in the Global treatment.*

[14]Unless otherwise noted, statistical results are based on logit models with standard errors clustered on subjects. All p-values are based on two-tailed tests.

[15]This high transfer rate may not be surprising, since transfers are already documented to be common in power-to-take games (e.g., Bosman and van Winden (2002)) and vendetta games. Transfers could also be due partly to experimenter demand effects (Zizzo, 2010), since transferring is the main activity of the study. If demand effects were a principle driver of transfers, one might expect them to decline with experience. To the contrary, however, we see a slight *positive* trend in transfer frequency across rounds, although this trend is not statistically significant (p-value=0.553)

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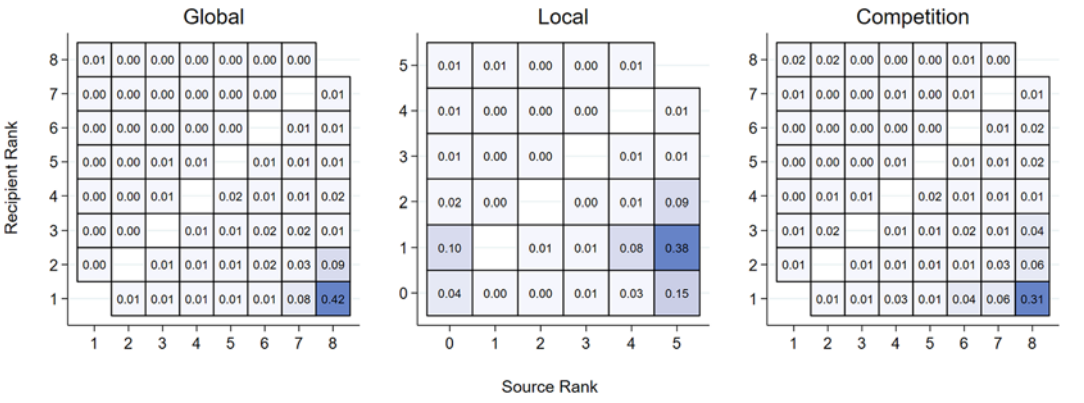


Fig. 3 Frequency of source and recipient of non-zero transfers
Note: Rank 1 has the lowest pre-transfer earnings. Rank 0 in the Local treatment refers to individuals outside a subject's local network, whose earnings are unobserved. Cell shading indicates the relative frequency of data in the cell.

Support: Figure 3 displays the frequency distribution of transfer sources (columns) and recipients (rows) for non-zero transfers. The dark cell in the lower right for the Global treatment, for example, indicates that 42 percent of all transfers moved amounts from the "richest" individual (rank 8) to the "poorest" (rank 1). This rate is modestly lower in the other treatments, but it is still by far the most common type of transfer. When excluding subjects in the highest and lowest ranks, who cannot make these types of transfers, the frequency of transfers from the highest to the lowest ranked individual are 55, 61, and 41 percent in the Global, Local, and Competition treatments, respectively. This frequency is significantly lower in the Competition treatment (p-value=0.049).[16] We explain this difference in Result 2 below, by demonstrating that pre-transfer competition leads some individuals to choose systematically different sources for their transfers.

These "Robin Hood" transfers that "rob from the rich to feed the poor" (Pyle, 1883) are at least four times more common than any other type of transfer. Such transfers are consistent with inequality aversion, particularly that the aversion to disadvantageous inequality is at least as strong as the aversion to advantageous inequality (i.e., $\alpha \geq \beta$ in the Fehr and Schmidt (1999) model, the basis of Hypothesis 2).[17] The frequent – and frankly unexpected – rate of Robin Hood transfers indicates, however, that the linear functional form for the utility function of the Fehr and Schmidt (1999) model is not a good approximation in this setting, as in Bellemare et al. (2008), since it implies that subjects would be indifferent between any transfer that moves earnings from any individual above themselves to anyone below themselves in the ranking. The simple linear version of this model does not predict the predominant frequency of transfers from the highest ranked to lowest ranked individual.

The source and recipient information in Figure 3 does not directly indicate whether transfers move earnings from someone above to someone below the decision-maker, because this depends on the decision-maker's own rank. This is considered in the following result concerning Hypothesis 2, where we also examine whether individuals in the Local treatment choose sources and recipients within or outside their reference group.

[16] Figure 10 in Appendix B shows that the frequency of these extreme transfer sources and recipients is similar in the T_1 and T_2 treatments.

[17] These types of transfers are also in line with the well-known Pigou-Dalton transfer principle of welfare economics which requires that, all else equal, social welfare increases following a transfer that reduces the inequality between two agents (see Moulin (2004, pp. 67-68) for further discussion of this principle). Fisman et al. (2021) also documents (for hypothetical earnings distributions) a preference to raise the bottom individual's income and lower the top individual's income. Targeting the "rich" is also common in the money-burning literature(e.g., Zizzo & Oswald (2001)), although in that experimental paradigm aggregate resources are destroyed whereas here earnings are only transferred.

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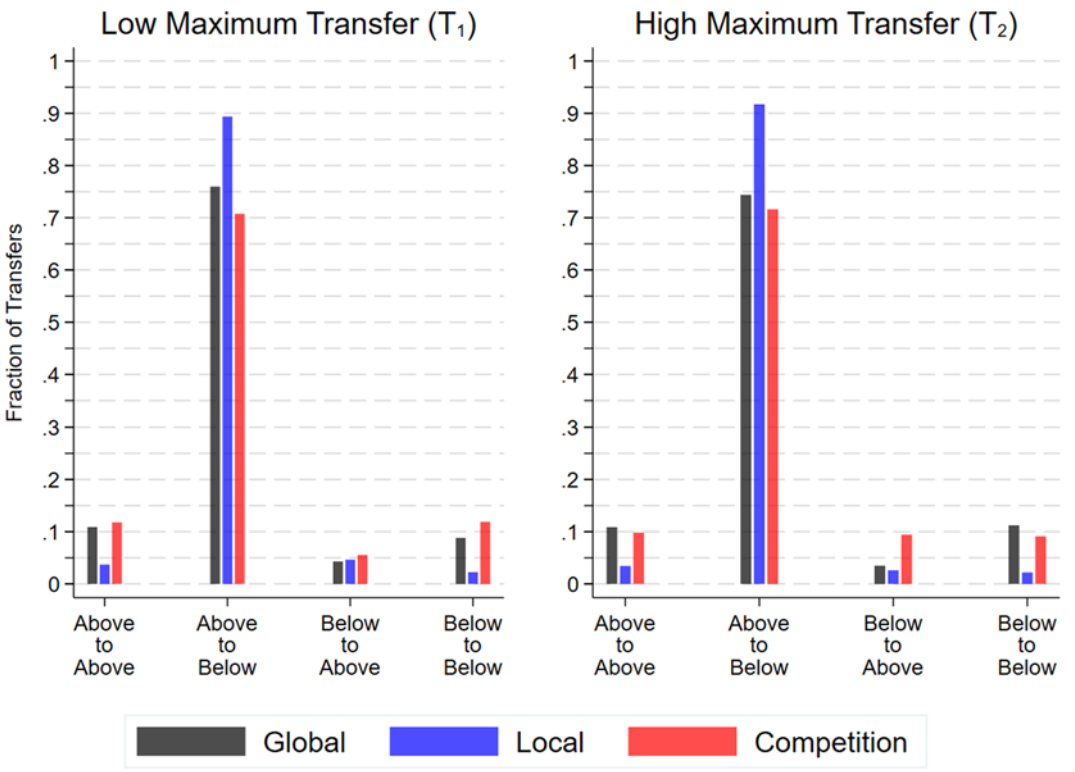


Fig. 4 Frequency distribution of in-to-in transfer types
Note: Restricted to positive, In-to-In transfers by individuals in ranks 2-7 in the Global and Competition treatments, and ranks 2-4 in the Local treatment.

Result 1. *The majority of In-to-In transfers move money from an individual ranked above to an individual ranked below the decision-maker, whenever possible, in all treatments. In the Local treatment, nearly all Out-to-In (In-to-Out) transfers involve a recipient (source) in a lower (higher) rank than the decision-maker, whenever possible. Out-to-Out transfers are uncommon.*

Support: Consider first In-to-In transfers, which account for all transfers in the Global and Competition treatments and about two-thirds of positive transfers in the Local treatment. For this analysis, we consider only individuals not initially in extreme ranks of their reference group (i.e., those in ranks 2-7 in Global and Competition treatments and ranks 2-4 in the Local treatment) since the types of In-to-In transfers that can be implemented by individuals holding the highest or lowest rank are naturally constrained when there is either no one in their reference group ranked higher or lower. Figure 4 displays histograms of In-to-In transfers, based on the rankings of the source and recipient relative to the individual implementing the transfer. The distributions are very similar in the T_1 and T_2 treatments.[18] Overall, transfers that select a higher ranked source and lower ranked recipient account for 75.2%, 90.5%, and 71.2% of positive, In-to-In transfers in the

[18]We tested for differences in the four types of transfers across the three treatments using a series of logit models with standard errors clustered on subjects. Only one of the 12 tests indicated a difference between the T_1 and T_2 treatments–the below-to-above rate in the Competition treatment.

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Global, Local, and Competition treatments, respectively. This provides strong support for part (a) of Hypothesis 2.[19,20]

In the Local treatment individuals may additionally implement Out-to-In, In-to-Out, and Out-to-Out transfers. Among all positive transfers in this treatment, In-to-In are most common (63.5%), followed by In-to-Out (18.6%), Out-to-In (13.7%), and Out-to-Out (4.2%) (cf. Figure 3). In support of parts (b) and (c) of Hypothesis 2, we find that Out-to-In transfers most often involve a recipient in a lower rank (81.5% overall, 93.5% when excluding transfers made by individuals in rank 1), and the majority of In-to-Out transfers target an individual in a higher rank as the source of the transfer (84.0% overall, 98.1% when excluding transfers made by individuals in the highest rank 5). The very low rate of Out-to-Out transfers provides support for part (d) of Hypothesis 2, which indicates that these types of transfers should not be implemented by inequality averse individuals because only one transfer is possible and only those transfers involving someone in the local group can reduce inequality.

Finally, as further general evidence of inequality aversion in this environment, we note that individuals' initial rank in the Local treatment influences the type of transfer they choose. Individuals who do not initially hold an extreme rank in their reference group (ranks 2, 3, or 4) are significantly more likely to implement In-to-In transfers (p-value<0.001) than those holding the highest or lowest rank. Relative to all other ranks, top ranked individuals (rank 5) more often implement Out-to-In transfers (p-value<0.001), while those in the lowest rank (rank 1) more frequently implement In-to-Out transfers (p-value<0.001).[21] These transfers from or to individuals outside the local group are the only way for those with extreme ranks to reduce inequality. Since, overall, Out-to-In transfers are not more common than In-to-Out transfers, in-group favoritism does not seem more important than inequality aversion or rank preferences.

Having established that people frequently make earnings transfers in this environment, in a pattern reflecting inequality aversion, we next examine the specific sources of the transfers and how this could reflect preferences regarding an individual's own ranking. Observation 2 already documents that transfers very frequently target the person with the highest earnings as the source. To test Hypothesis 3, we consider whether individuals source funds from the individual one rank above themselves. We also document how this is affected by pre-transfer competition. We set aside the Robin Hood transfers targeting the richest for this test, since such transfers already document that all individuals very frequently target the highest ranked, including those in the second-highest rank.

Result 2. Individuals in the Global treatment do not transfer from those immediately above themselves in the ranking at higher rates than others higher in the earnings distribution; those who lose the pre-transfer game in the Competition treatment, however, are more likely to transfer from the individual in the rank above themselves relative to those in the same ranks in the Global treatment.

[19] In the T_2 treatment subjects could make a transfer that is greater than \$2 from the individual immediately above themselves to the the individual immediately below themselves in the ranking, thereby leaving their own rank unchanged but reducing self-centered inequality. Such transfers are very rare, however, accounting for about 1% of all positive transfers in the T_2 treatment.

[20] This high rate of transfers that are consistent with inequality aversion exceeds estimates in Amiel et al. (1999), who found that a majority of their survey respondents did not exhibit inequality aversion. But the different methodology used in this earlier study, in particular its use of a "leaky bucket" approach that made transfers costly in order to estimate inequality preferences, makes the estimates not directly comparable.

[21] Controlling for own rank in the local group, Out-to-In transfers are marginally more likely when the average earnings in the in-group are lower (p-value$=0.097$). In-to-Out transfers are directionally more common if the in-group has higher average earnings, but this is not statistically significant (p-value$=0.305$). Logit regressions showing that Out-to-In (In-to-Out) transfers are made more (less) often by those in higher ranks are statistically significant regardless of whether we use the Local rank (1-5) or the Global rank (1-8).

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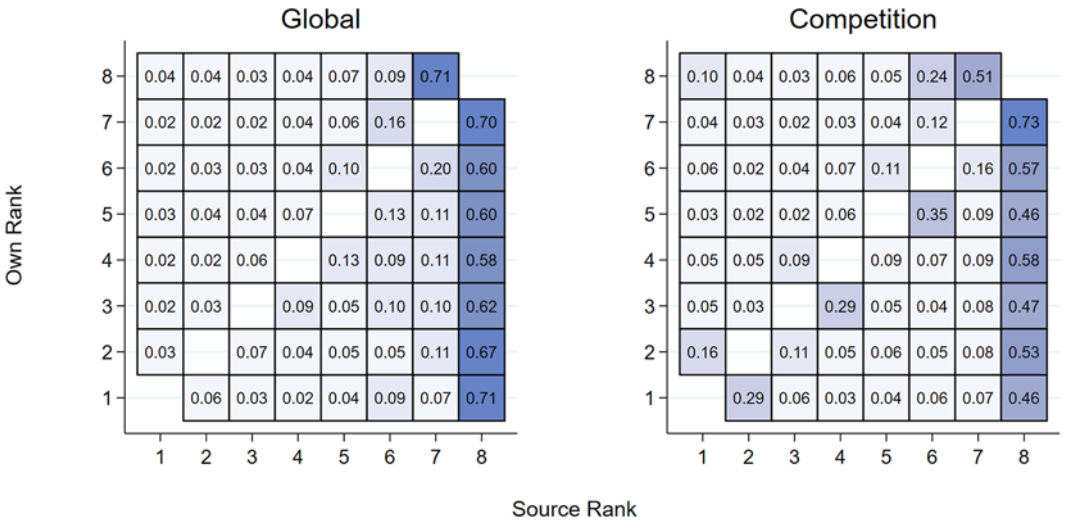


Fig. 5 Frequency of source of non-zero transfers
Note: Rank 1 has the lowest pre-transfer earnings. In the Competition treatment, individuals in ranks 1, 3, 5, and 7 lost the pre-transfer competition, while those in ranks 2, 4, 6, and 8 were the competition winners. Cell shading indicates the relative frequency of data in the cell.

Support: Figure 5 shows the transfer source depending on the subjects' own rank to identify the individuals targeted by the transfers.[22] Inequality averse subjects should select those higher in the ranking; that is, to the right of the empty diagonal. This is clearly supported by the data, as over 86 percent of non-zero transfers made by individuals not in the highest rank target the higher ranks in this region (87 percent in Global and 84 percent in Competition). Figure 6 shows that the recipient of these transfers is almost always in a lower rank than the decision-maker, which is also implied by inequality aversion. Over 85 percent of non-zero transfers in the Global and Competition treatments made by individuals not in the lowest rank choose a recipient in a lower rank (87 percent in Global and 84 percent in Competition). Such transfers are even common for subjects in the second-to-lowest rank, who most commonly benefit the lowest-ranked individual as their transfer recipient. Some even made transfers large enough to lower their own rank: this occurred in 116/240 (48 percent) of opportunities in the Global treatment, but just (68/240=28 percent) of opportunities in the Competition treatment.

In the Competition treatment, subjects first played a zero-sum (matching pennies) game with the individual who was endowed with the same amount to determine the pre-transfer earnings distribution. Those in ranks 1, 3, 5, and 7 were competition losers, and they knew that they lost to the individuals in ranks 2, 4, 6, and 8, respectively. Figure 5 shows that these individuals one rank higher are the most common target for the competition losers in these odd-numbered ranks, other than the richest (rank 8) individuals. The winners in ranks 2, 4, and 6 are targeted about 30 percent of the time. This pattern is completely absent in the Global treatment, which did not include this pre-transfer competition stage.

Hypothesis 3 states that when subjects choose transfers large enough to change ranks, they are more likely to target as the source the individual directly above themselves in the ranking. Logit models (clustering on individuals) shown in Table 3 in online Appendix B indicate a pattern consistent with this prediction, as the likelihood of choosing a rank-changing transfer amount is significantly greater when targeting the individual directly higher in the distribution

[22]Figure 11 in Appendix B demonstrates similar patterns for the T_1 and T_2 treatments separately, as well as for the subset of transfers greater than $2 that change rankings.

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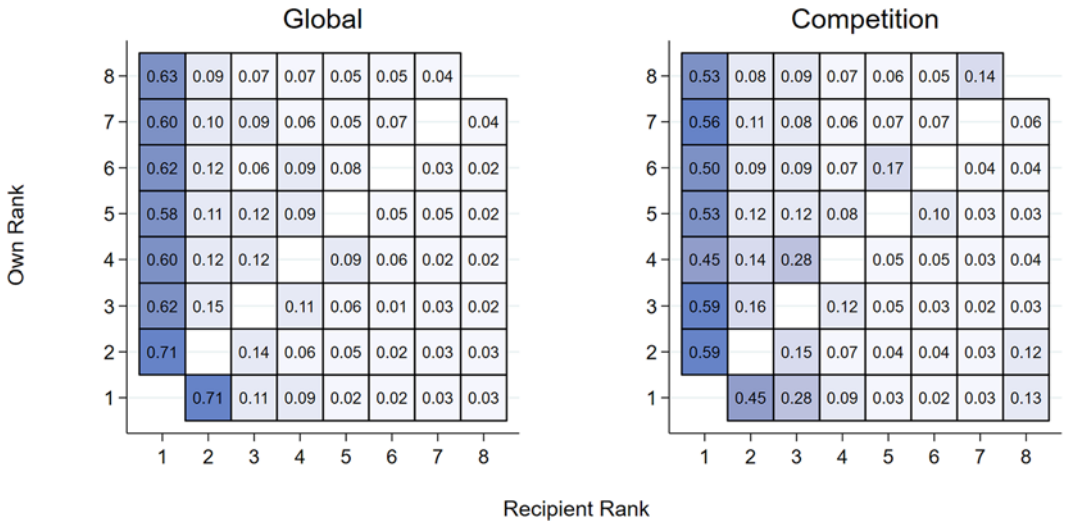


Fig. 6 Frequency of recipient of non-zero transfers

Note: Rank 1 has the lowest pre-transfer earnings. In the Competition treatment, individuals in ranks 1, 3, 5, and 7 lost the pre-transfer competition, while those in ranks 2, 4, 6, and 8 were the competition winners. Cell shading indicates the relative frequency of data in the cell.

(p-value=0.012).[23] Considering the treatments separately, however, this effect is only statistically significant in the Competition treatment (p-value=0.048) and not in the Global (p-value=0.086) or Local (p-value=0.284) treatments. Due to limited precision of the coefficient estimates, they do not differ statistically across treatments.[24] One interpretation of the more consistent targeting of individuals directly above in the ranking is that pre-transfer competition apparently strengthens rank preferences; in terms of the model presented in Section 3, competition raises γ_i for competition losers. Another interpretation is that it may trigger emotions such as anger and induce individuals to take revenge. To test this interpretation an anonymous referee suggests a follow up experiment with a larger prize (say, $3) in the preliminary competition. Revenge would lead subjects to target the individual two ranks above themselves (i.e., their victor) rather than one rank above.

Before turning to further evidence supporting Conjecture 1, consider Hypothesis 4. This hypothesis follows from the assumption that individuals' rank disutility increases when they are further down in the earnings distribution. This would increase the frequency of targeting the individual directly above as the source of the transfer among those lower in the earnings distribution.

Result 3. *Individuals lower in the earnings distribution do not target the individual above them to increase their own ranking more than individuals higher in the distribution.*

Support: Figure 12 in Appendix B indicates that in all treatments, the most prominent pattern is the second-highest ranked individual targeting the highest-ranked, already documented in Observation 2. Excluding this position in the earnings distribution, the rates of targeting the individual directly above decline or tend to be flat when moving down the distribution. The trend is significantly

[23] We consider only cases where rank-improving transfers are (intentionally) possible; i.e., excluding all observations where the individual holds the highest rank in their reference group, and in the Local treatment, omitting cases where the individual one rank higher (globally) is not in the participant's reference group.

[24] It is also notable that in the Competition treatment, 50 of the 134 rank-changing transfers (37%) made by the poorest individual in rank 1 targeted the person directly above themselves (in rank 2), even though this rank improvement increased inequality by transferring to a higher-ranked individual. By contrast, only 15 of the 166 rank-changing transfers (9%) made by the poorest individual in the Global treatment targeted rank 2 to raise their own ranking.

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Table 2. Frequency of Rank-Improving and Rank-Worsening Transfers

	Session Type		
	Global	Local	Competition
Rank-Improving	0.126	0.118	0.183
Rank-Worsening	0.101	0.111	0.083
Observations	1,680	931	1,680

Note: Frequency of transfer types are calculated only for the cases where such types are feasible.

negative, contrary to Hypothesis 4, in the Global treatment according to logit regressions (p-values<0.01) and insignificant in the other treatments (p-values>0.529). Results are similar, although less statistically significant, in the Global treatment when considering only rank-increasing transfers (p-value$=0.092$).

Our last observation compares the transfer patterns across treatments to evaluate Conjecture 1.

Observation 3. *Rank-improving transfers are significantly more frequent in the Competition treatment than in the Global or Local treatments, and they are concentrated among pre-transfer game losers. Rank-worsening transfers occur most frequently when individuals transfer to the lowest ranked in the distribution, and their rate does not vary significantly across treatments.*

Support: The first row of Table 2 displays the frequency that subjects choose to transfer more than \$2.00 from the individual ranked immediately above themselves to an individual not immediately below, thus increasing their rank in the distribution. For the Global and Local treatments without pre-transfer competition, this rate is about 12% and is not significantly different across these treatments (p-value$=0.745$). This rate increases by about 50% in the Competition treatment, to over 18% overall. This increase is statistically significant (p-value$=0.045$). The second row of the table shows that large transfers to the individual immediately below, which worsen a subjects' rank, occur 8-11% of the time, and these rates are not significantly different across treatments. The largest fraction of these rank-worsening transfers (67%) are made by subjects in position 2 transferring to the poorest in position 1.

Figure 5 and Result 2 already document that pre-transfer game losers (i.e., those initially in odd-numbered ranks) more frequently target the individual they lost to (immediately above them in the ranking) as the source of their transfer. Figure 7 shows that the same holds for rank-improving transfers. With the exception of rank 7, which has the highest number of such transfers – due largely to the high frequency of Robin Hood transfers – those in the odd-numbered ranks select rank-improving transfers at least 2.5 times more frequently in the Competition than the Global treatment. This difference is statistically significant (p-value<0.001). Rank-worsening transfers are most common for those in rank 2, again due to the common Robin Hood transfers documented in Result 2.[25]

We conclude by documenting subject-level heterogeneity in the rates at which individuals implement rank-improving and rank-worsening transfers. Figure 8 shows the empirical CDF of transfer type frequencies, disaggregated by gender. First, note the considerable heterogeneity across subjects. A nontrivial portion never implement transfers that change ranks, while others do so frequently – particularly for rank-improving transfers. Second, note that men more

[25]Figure 13 in Appendix B displays the CDF across subjects of transfer type frequencies separately by treatment. Kolmogorov-Smirnov tests indicate significantly fewer rank-worsening transfers in the Competition treatment than either of the other two treatments (both p-values$=0.012$) and marginally greater rank-improving transfers in the Competition than the Global treatment (p-value$=0.059$).

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Fig. 7 Frequency of rank-improving and rank-worsening transfers, by rank
Note: Results are based on Global and Competition treatments where all ranks are observable. Rank 1 has the lowest pre-transfer earnings. In the Competition treatment, individuals in ranks 1, 3, 5, and 7 lost the pre-transfer competition, while those in ranks 2, 4, 6, and 8 were the competition winners.

frequently implement both types of rank-changing transfers.[26] The gender difference in the rates of rank-worsening transfers is significant (p-value=0.014) according to a Kolmogorov-Smirnov test, while the difference in the rates of rank-improving transfers is marginally significant (K-S p-value = 0.073).[27] Examining each treatment independently, we find a significant difference in the rates of rank-improving transfers only in the Competition treatment (K-S p-value=0.039), while the difference in rank-worsening transfers is significant in both the Local (K-S p-value=0.032) and Competition (K-S p-value=0.013) treatments. Figure 14 in Appendix B shows a similar figure disaggregating the kinds of transfers according to the preference type measured in the social value orientation task.[28] This reveals a smaller and significant (K-S p-value=0.047) lower rate of rank-improving transfers among prosocial (relative to

[26]Four of the 192 subjects chose "other" or "prefer not to say" as responses to the gender question and are thus not included in the figure.

[27]Little existing evidence exists for gender differences in rank preferences. Kuziemko et al. (2014) find that men are significantly less supportive of minimum wage increases than are women, but this holds across the earnings distribution and not only for low earners who may face a change in their own rank. Gill et al. (2019) find no evidence that their estimated U-shaped rank response function varies by gender.

[28]This figure only shows CDFs for Individualistic and Prosocial types, which account for nearly all (190 of 192) of the participants in our experiment.

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Fig. 8 Rank-improving and rank-worsening transfers, by subject split by gender
Note: Rates are calculated based only on cases where rank-improving or rank-worsening transfers are feasible.

individualistic) types.[29] These findings suggest that women, and to a lesser extent prosocial types, may have weaker rank preferences.

5. Concluding remarks

This paper presents a novel experimental design to measure individuals' preferences over their ranking in a distribution of earnings. Subjects could transfer money between others, but not change their own earnings. Therefore, their decisions are determined only by their social preferences. The experiment varied the size of the reference group and whether "outsiders" existed beyond the subjects' own network, who could still be sources or recipients of transfers.

Although they always had the option to make small or even zero transfers, subjects generally preferred to make large transfers – large enough, even, to change the initial ranking hierarchy. This contrasts directly with the findings of Xie et al. (2017), who employ a very different experimental design and report an aversion to change others' earnings ranking. Subjects' modal choice in our experiment was to transfer the maximum possible amount from the richest to the poorest individual in the distribution. These "Robin Hood" transfers were even very common for those in the second-to-last position in the distribution, despite the fact that this lowered their own rank. This provides evidence that stated preferences over redistribution from surveys (e.g., Kuziemko et al. (2014)) may

[29]This appears to be driven by differences in the Global treatment (K-S p-value=0.017), while there is no significant difference in the Local (K-S p-value=0.999) or Competition (K-S p-value=0.274) treatments. Rates of rank-worsening transfers are not significantly different by SVO type overall (K-S p-value=0.161) or in any individual treatment: Global (K-S p-value=0.953), Local (K-S p-value=0.273), Competition (K-S p-value=0.390).

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differ from revealed preferences over actual earnings redistribution. Robin Hood transfers were much more common than any other type of transfer, and they are consistent with inequality aversion. They suggest support for redistributive policies that target those highest in the wealth or income distribution, rather than a focus on an individual's own location in the distribution. As noted earlier, the high frequency of these transfers also indicates that the linear functional form for the utility function of this model is not a good approximation in this setting. Instead, while still consistent with inequality aversion, this transfer pattern indicates that disadvantageous inequality aversion is an increasing and concave function of the payoff difference.

Targeting the individual with the highest earnings also reduces disadvantageous inequality for the largest number of agents in the group. The modal transfer that takes from the richest and gives to the poorest reduces payoff variance and raises only the inequality experienced by the richest, while all seven others in the group experience a decrease in disadvantageous inequality. For decades behavioral economists have modeled (and explored the implications) of social preferences, focusing on concerns about the earnings or wealth of others. Transfers observed in this experiment that reduce others' disadvantageous inequality may reflect second-order preferences over others' disutility due to social preferences. At a minimum, this suggests the limits of self-centered inequality aversion, as modeled in seminal studies such as Fehr and Schmidt (1999) and Bolton and Ockenfels (2000). The policy implications of such concerns include strong support (among those possessing preferences over others' inequality aversion) for a highly progressive tax code.

The experiment also includes a treatment with pre-transfer competition. The competition outcome, determined by a matching pennies game, was random. It had little impact on the rate of transfers consistent with inequality aversion, lowering them from 75 to 71 percent (Figure 4). It apparently strengthened rank preferences, however, perhaps through triggering emotions. Competition losers more frequently targeted the individual directly above themselves in the distribution as their transfer source, and this increased the overall frequency of rank-improving transfers from 12.6 to 18.3 (Table 2). Even in this treatment, however, the overall rate of transfers that raise a subjects' own position in the earnings distribution is considerably less than the fraction of transfers consistent with inequality aversion, suggesting that for many subjects rank preferences may be outweighed by inequality aversion. While many subjects make choices that are indicative of preferences over rank, for many this effect is secondary to their stronger aversion to inequality overall. It may be that the extent to which rank preferences impact behavior is context specific, and future research should investigate the types of environments in which such preferences have a larger influence.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/eec.2025.10015.

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