Rank versus Inequality—Does Gender Composition Matter?*

Duk Gyoo Kim† Max Riegel‡

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Abstract

We conduct a laboratory experiment that investigates allocation decisions when facing a rank–inequality tradeoff. In particular, we examine how the gender composition of others ranked adjacent to the decision makers affects their allocation decisions. Two essential features of our experiment are that (1) participants' relative rank is the outcome of their real-effort performance and luck, and (2) the genders of other participants at different ranks are naturally revealed. We find that the female subjects are more reluctant to give up their current relative rank (and alleviate the inequality by doing so) when the persons ranked below and above are males. This tendency is less pronounced for male subjects.

JEL Classification: C91, D63

Keywords: Gender composition, Positional concerns, Preferences for Redistribution, Last-place aversion, Perception of luck

1 Introduction

Imagine a situation where you have to choose either (1) to give up your current relative rank or position for reducing economic inequalities around you or (2) to keep the current rank for

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†Department of Economics, Sungkyunkwan University. Email: kim.dukgyoo@skku.edu

‡Department of Economics, University of Mannheim. Email: mariegel@mail.uni-mannheim.de

exacerbating the inequalities, but your absolute monetary payoffs are unaffected in both cases. Although drastically simplified, this situation captures the tradeoff relationship between the concern for relative rank and the social preference for distributional outcomes. Regarding the hypothetical situation, our research questions are the following: How is your decision affected if you know the genders of the rank-above and the rank-below persons? Would your decision differ when you obtain a relatively lower/higher rank? To answer our research questions, we conduct laboratory experiments to examine whether gender composition matters for the experiment participants' allocation decisions in a plausible environment where both individual performance and luck jointly determine their payoff-relevant rank.

Our question stems from two actively-studied research agendas: the utility from a relative rank and the preferences for redistribution. Although muted in most economic theories, the utility from a relative rank or a concern for relative position drives our daily decisions and affects the level of happiness to a non-negligible extent.[1] In the two-dimensional space of incomes and favors toward progressive tax–redistribution policies, the standard economic models à la Meltzer and Richard (1981) predict that the preferences for redistribution should be negatively aligned with the income levels. However, we sometimes observe "off-diagonal" preferences for redistribution: Some low-income citizens vote against redistribution, while some high-income citizens vote for it. Among several plausible ways of attempting to answer "why the poor vote for the rich,"[2] we are interested in the role of the utility from a relative rank.

The broad question about the relationship between the concern for the relative position and the preferences for redistribution has been examined in various forms. Kuziemko et al. (2014) provide experimental and survey evidence that individuals may be averse to placing themselves in the last place and claim that the concern for their relative position leads to

[1]The concerns for relative standing were recognized by early philosophers such as Veblen (1899), Keynes (1930), and Russell (1930). Following Duesenberry (1949), some theoretical studies focus on the resource allocation to positional goods (Frank, 1985; Hirsch, 1995; Hopkins and Kornienko, 2004) and discuss possible policy interventions (Frank, 2008) and optimal taxation (Aronsson and Johansson-Stenman, 2010, 2018). For a broader review of the literature on relative rank and happiness, see Clark et al. (2008).

[2]The low-income citizens with the prospect of upward mobility may believe that redistribution will prevent them from prospering in the future (Benabou, 2000). Biased perceptions in individuals' evaluations of their own relative positions (Cruces et al., 2013) or heterogeneous beliefs about intergenerational mobility (Alesina et al., 2018) could affect preferences for redistribution. The public may be sensitive to the media coverage of household-income inequality rather than the inequality itself (Kelly and Enns, 2010). Doubts about the political system and the government's efficiency may prevent the poor from being liberal (Houtman et al., 2008). The social and cultural conservatism applied to a specific region (Frank, 2004) or religion (Guiso et al., 2003) may drive opposition to the political party which advocates economic redistribution. Meanwhile, some high-income citizens' support for redistribution can be explained when morals are viewed as luxury goods (Enke et al., 2022).

opposition to redistribution. Kim (2019) shows that the puzzling dynamics between severer income inequality and a smaller fraction of low-income citizens demanding redistribution could also be related to the concern for relative position. Gallice and Grillo (2019) posit that people care for relative standing in both consumption and social class. The redistribution policy affecting the relative standing in consumption also distorts the importance of social class differences, leading to opposition to redistribution in some cases. Xie et al. (2017) provide experimental evidence that a third-party subject, to some extent, prefers to avoid decisions that reverse the existing rankings and claim that the rank-reversal aversion may be innate. However, to the best of our knowledge, little is known about the role of the gender composition of persons adjacent in rank to the decision maker. The gender composition could affect the decision maker's well-being via both channels—preferences for rank and redistribution. On the one hand, individuals could be habituated to care more about their intra-gender rank, as many real-life reference groups, including sports teams, circles of friends, and professional networks in sectors dominated by one gender, consist of only men or women. Also, pairing or marriage decisions involve only intra-gender comparisons. On the other hand, evidence from dictator games (Saad and Gill, 2001; Ben-Ner et al., 2004) suggests that preferences for redistribution might depend on the gender of the decision maker's counterparts. We contribute to the literature by experimentally investigating the effect of gender composition on allocation decisions when facing a rank–inequality tradeoff.

We face two empirical challenges, which are essentially the reasons for using a laboratory experiment to answer our research questions. One challenge is to make the gender information salient without imposing an emphasis on it. The other one is to allow for within-subject variation in rank over rounds, while ranks should not be entirely random. In our experimental setting, the gender information of other subjects is revealed innocuously by displaying the (gender-identifiable) nicknames chosen by themselves for anonymity, and the luck factor and the subject's performance determine the relative rank of the subject in approximately equal weights. We believe both experimental features have contributions to the methods in experimental economics, as the revelation of innocuous gender information can be used in many other experimental studies,[3] and the adjustments of the random scaling parameter allow us to examine another underexplored aspect regarding the preferences for

[3]Making gender salient without an unnecessary emphasis is easier said than done, as those have a tradeoff relationship. Sometimes the concern for the demand effect makes the gender salience weak: For example, Baranski et al. (2021) use colors (pink for female subjects and blue for male subjects) as cues for gender information in the three-person bargaining experiment without any explanation about what the colors mean. The opposite case also exists: For example, Solnick (2001) uses real first names (and tries to exclude participants with unrevealing first names) to examine gender differences in the ultimatum game.

redistribution—the (perceived) attribution of luck and effort for economic achievement.[4]

The experiment primarily consists of two main stages. Before the first stage, the subjects were asked to provide basic demographic information, including gender. In the first stage, the participants individually work on a real-effort task, only knowing that better performance will be more likely to lead to a higher payoff. In the second stage, the participants were randomly divided into groups of six, told their monetary payoffs are determined by their relative rank within the group, and informed about their rank, which is based on the first-stage-performance scaled by a luck factor (dice roll of a computer). The main task of the second stage is to allocate additional money either to a subject at one rank above or to a subject at one rank below, with knowing the genders (via the gender-identifiable nicknames) of all group members. After repeating the second stage five times, with new groups being randomly formed each time, the subjects fill out the post-experiment survey, which includes their perceptions about the role of luck and their performance.

We find that the female subjects were more reluctant to give up their current relative rank (and alleviate the inequality by doing so) when the rank-below and rank-above persons were males. That reluctance of a male subject surrounded by females is not as significant as that of females. We do not find support for Last-Place Aversion (Kuziemko et al., 2014), the reluctance to allocate downward when ranked second from the bottom.

The remainder of this paper is organized as follows. The following subsection provides an overview of the relevant literature. Section 2 outlines the experimental design, the hypotheses, and the procedures. Section 3 reports the results of the experiment, and Section 4 concludes.

1.1 Literature Review

Our experimental design adopts the Encryption Task used in Erkal et al. (2011) and the money allocation task used in (Kuziemko et al., 2014, henceforth KBRN). The Encryption Task is to repeatedly decode a random sequence of letters into corresponding numbers using a decoding table in a given time. Our experimental setup is similar to theirs in the sense that the individual's earnings are determined by the relative rank of the task performance, not the absolute level of performance. The major difference is that we have considered a luck factor adjustment so that each subject's rank can substantially vary, although their relative level of performance within a group varies less.

[4]By adjusting the support of the luck scaling factor, we could build different institutions varying from a complete meritocracy (when luck plays no role) to a complete ex-ante egalitarian (when luck dominates effort).

Although our primary research question is not on examining KBRN's Last-Place Aversion, it is worth discussing as our experimental design allows us to examine it in the second stage. Motivated by the fact that some workers whose hourly wage is just above the minimum wage rate do not support the idea of raising the minimum wage, KBRN conducted an experiment where each subject in a group of six was randomly assigned a payoff-relevant rank and asked to decide whether to allocate additional money to a rank-above person or a rank-below person. KBRN find that subjects at the second rank from the bottom are distinctively reluctant to allocate money to the person in the last place, calling this effect Last-Place Aversion (LPA). The replication of their experiment (Camerer et al., 2016) reports the opposite effect, questioning the validity of the observations. Martinangeli and Windsteiger (2021) replicate and extend KBRN, claiming that the way of rank assignment in each decision round might be an issue. While the ranks in KBRN are randomly and newly assigned to the subjects in each round, Martinangeli and Windsteiger (2021) also consider a treatment where the randomly assigned ranks are maintained over the entire decision rounds. Assigning the same rank for the entire experiment might render the subjects some sense that the rank is endowed, but it cannot observe how the subjects' decisions vary with rank. Our experimental design embraces the advantages of the design considered in KBRN and Martinangeli and Windsteiger (2021): By taking the performance in the real-effort task as a base, each subject's rank is determined by a rank of the adjusted performance that is scaled by a luck factor. This way, we can render the sense that the subject's "average" rank is endowed, yet the subject's rank varies by decision round.

Laboratory experiments on gender differences form another important strand of the related literature. We focus on a subset of studies that help us form conjectures on the effect of gender composition on redistribution. Overall, the results are mixed: Some studies hint that women tend to allocate money to a man at a lower rank, while others suggest the opposite. Ben-Ner et al. (2004) report that in a dictator game context, women give less to other women when gender information is available. Dalmia and Filiz-Ozbay (2021) report that the behindness aversion is distinctive among women, and Dasgupta et al. (2019) also find evidence for stronger behindness aversion among women. Regarding our experimental setting, these findings suggest that a female subject might allocate less to a woman at a lower rank. On the other hand, women give more in a dictator game (Eckel and Grossman, 2001; Bilén et al., 2021) and in a variant of the dictator game called the solidarity game (Selten and Ockenfels, 1998). Also, women tend to favor redistributive policies compared to men (Alesina and Giuliano, 2011; Funk and Gathmann, 2015). These observations may indicate

that women are more inequality-averse than men; hence a female subject would allocate more to a subject, regardless of gender, at a lower rank.

More mixed yet, our experimental setting involves noisy feedback in the performance, so gender differences in the perception of the feedback may affect the allocation decision. Shastry et al. (2020) examine the gender difference in tournament entry upon receiving noisy feedback about relative standing. They find that women tend to attribute negative feedback to lack of ability even when it was actually due to bad luck. In our experiment, if the female subjects feel that they "deserve" their rank (and the rank-related payoffs), it may suggest that they could be more lenient in allocating downward. In other words, their preference for distributional outcomes could dominate their concern for relative rank. Meanwhile, women perform competitive tasks better in a single-gender environment (Gneezy et al., 2003) and exert more effort in contests when competing against other women (Mago and Razzolini, 2019). These results are not directly applicable because, in our experimental setting, the subjects individually perform the real-effort task without knowing how exactly the individual performance is translated into the monetary payoff. However, if women's competitive behaviors when surrounded by women are the response to the concern for the intra-gender relative rank, a female subject in our experiment may be reluctant to allocate to a woman at a lower rank.

2 Experimental Design, Hypotheses, and Procedure

2.1 Design

We adopt a within-subject design where the main source of variation is the gender composition of adjacent subjects. The primary interests of the experiment are to observe (1) how gender composition affects the allocation decision, (2) how such effects vary in the subject's current rank, and (3) how the perception of luck affects the allocation decision.[5]

Prior to the main parts of the experiment, the subjects were asked provide basic information such as gender, age, a field of study, and previous experience of online experiments, without leaving any question unanswered. Since our main manipulation is to make the group members' genders salient, while avoiding the experimenter demand effect (Zizzo, 2010) of hinting the subjects that the revelation of the gender is crucial, we did not emphasize any part of the questionnaires.[6]

[5]The complete experimental instructions are in Appendix A.

[6]In addition, since the first part of the experiment—the individual real-effort task—has nothing to do with

The experiment consisted of two main parts. In part 1 of the experiment, the subjects worked on an Encryption Task (Erkal et al., 2011) for 5 minutes. Per trial, each subject was given a sequence of five random letters and a decoding table showing how each letter maps into a number. Their task was to decode the letters into the corresponding numbers in the table. For example, if a text sequence YDDYO is given, and a decoding table says that D, O, and Y respectively correspond to 3, 6, and 8, then the correct answer is 83386. For each text sequence, a new decoding table was provided. The subjects were told that the more correct answers, the more money they were likely to earn. Except that we informed the subjects that earnings would be based on their decisions, others' decisions, and some luck, we did not provide further details of how their payoffs would be determined at this stage. Previous studies report no significant gender differences in the Encryption Task performance (Erkal et al., 2011).

Part 2 of the experiment consisted of five decision-making rounds. Figure 1 shows how Part 2 proceeded. After an overview of the design, we discuss the specifications.

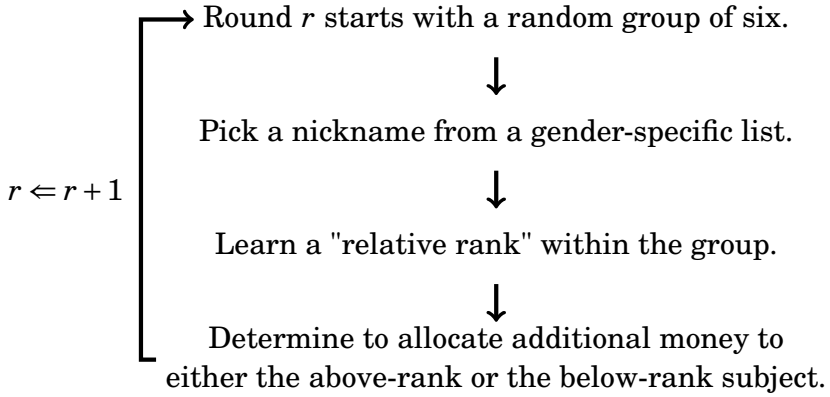

Figure 1: Flowchart of Part 2

At the beginning of each round, the subjects were randomly assigned to a group of six, and each of them picked their nickname from a provided gender-specific list of alternatives. We explained that picking a nickname is a way to make every subject remain anonymous yet clearly distinguish other subjects in the group by their nicknames. After they picked their nicknames, a server computer calculated and displayed their *relative rank* within the group. The rank was determined by their performance in Part 1, scaled by the outcomes of computerized dice rolls. Specifically, a rank of subject i, R_i, is determined by $\#\{j \in G_i | P_j \times [D_j + 2] \geq P_i \times [D_i + 2]\}$, where G_i is a group for subject i, P_j is the performance measure

the gender, we believe that the experimenter demand effect, if any, is negligible.

(i.e., the number of correct answers in Part 1) of subject j, and D_j is the random outcome of a computerized dice roll for subject j. In the case of a tie, a subject whose subject number (a unique number internally assigned to each subject) is smaller received a better rank. We instructed the subjects that the computer randomly rolled a dice for each subject, calculated the "adjusted performance," which is the number of correct answers in Part 1 multiplied by [dice roll+2], and showed the relative rank of the adjusted performances within the group. For example, if subject 1 gave 10 correct answers in Part 1, her adjusted performance could vary from 30 ($= 10 \times [1+2]$) to 80 ($= 10 \times [6+2]$). The subjects received different amounts of money according to the ranking: The person obtaining rank r, $r \in \{1,2,\ldots,6\}$, receives $17-2r$ euros. Since the subjects were only informed about their relative rank, they can infer neither the realization of the dice roll nor the other group members' actual performance measures.

After every subject observed the initial money amounts, they were asked to allocate two additional euros to one of the two adjacent subjects in ranking. For example, a third-rank subject was asked to allocate two additional euros to either the person ranked second or fourth. For notational simplicity, we call the person who is at one rank above the subject the Rank-Above and the person who is at one rank below the subject the Rank-Below. The subject ranked first (last) had only one option to allocate money to the Rank-Below (Rank-Above). Since the base payoff of each rank increases by two euros, allocating the additional two euros to the Rank-Below implies that the subject chooses to sacrifice her relative rank. Participants were told that the allocation decision of only one randomly selected subject would be implemented. Final payoffs were not displayed such that other subjects' decisions remain unknown.

For every new round, the subjects repeated the procedures mentioned above. All subjects were reshuffled to be assigned to a new group of six. The computer rolled new dice for the new round, independent of the previous outcomes. The new ranking was then determined based on their performance in Part 1, their new group members' performance, and the new dice rolls. Once all the five rounds ended, the computer randomly selected one round and one group member's allocation decision for actual payment. Until the end of the experiment, the subjects did not get any feedback.

Several points are worth discussing. We made the subjects' gender salient by asking them to pick one fictitious name from a list of popular names.[7] Thus, it is crucial that the

[7] Chakraborty and Serra (2021) also asked the experiment participants to choose a nickname from a list of gender-specific names. However, their primary purpose is to prevent confounding bias of race, nationality, or ethnicity associated with the subject's actual name, so they used distinctively white-sound names taken from Bertrand and Mullainathan (2004), and the chosen nickname is used throughout the entire experiment.

subjects can unambiguously grasp the gender of the other subjects. For this purpose, we carefully selected the list of first names. First, we collected 100 boy names and 100 girl names popular for babies born in the 1990s and 2000s, excluding known unisex names. Most experiment participants were born in the 1990s and 2000s, so the name list contains contemporary names from their perspectives.[8] Afterward, we asked 80 Amazon Mechanical Turk participants to classify the 200 names as male, female, or unsure/unisex and used 60 names for each gender on which the survey participants formed a near-consensus as boy and girl names.[9] We filter survey respondents to have 29 German-speaking, 37 European, and 14 Asian respondents. This procedure aims to match the proportion of the survey respondents with that of participants of other experiments using the same subject pool.[10] Also, to avoid potential confusion, every experiment participant received different name options per round, so the subjects were not concerned about possible duplication within a round.

We carefully calibrated the range of the random scaling factor, 3 to 8 from [dice roll+2], that determines the adjusted performance. If the random scaling factor varies too much compared to the performance variance among subjects, then the actual performance would not matter for the relative rank. On the contrary, if the random scaling factor varies too little, the relative rank across rounds would also vary too little. Ideally, we wanted to achieve that the relative rank is equally accounted for by the actual performance rank and the luck factor.[11]

The main experiment was followed by a post-experiment survey, which includes the guess of the actual rank in performance, the perceived beliefs about the luck factor, and a general view about the inequality caused by luck.

[8] An undesirable side effect is that participants might attribute good or bad personal impressions to certain first names. However, we claim that such name effects are orthogonal to rank and gender composition and thus do not affect our primary observations in aggregate.

[9] The following boy names are used: Aaron, Adam, Albert, Anthony, Arthur, Christopher, David, Derek, Edward, Ethan, Frank, Fred, Hugo, James, Jason, Patrick, Peter, Richard, Robert, Ronald, Steven, Thomas, Walter, Xavier, Benjamin, Brandon, Bruno, Charles, Christian, Daniel, Diego, Eric, Gregor, Isaac, Ivan, Jacob, John, Jonathan, Kevin, Leonard, Manuel, Marco, Matthew, Nicholas, Norman, Paul, Phillip, Ralph, Samuel, Scott, Stanley, Victor, Vincent, William, Alexander, Andrew, Brian, George, Henry, and Oscar. The following girl names are used: Alyssa, Elena, Helena, Isabella, Jasmine, Jennifer, Lisa, Luisa, Monica, Sarah, Sylvia, Alicia, Angelica, Christina, Jessica, Julia, Katherina, Lara, Laura, Marisa, Olivia, Rebecca, Regina, Samantha, Sandra, Selina, Teresa, Claudia, Cynthia, Elizabeth, Ella, Eva, Lena, Linda, Lydia, Melissa, Mia, Michaella, Natasha, Rose, Sabrina, Sophia, Ariana, Bianca, Cassandra, Clara, Daniela, Diana, Emily, Emma, Erica, Lily, Maya, Vanessa, Alina, Amanda, Gloria, Maria, Stella, and Victoria.

[10] See Online Appendix Section A for mTurk instructions and other details.

[11] See Online Appendix Section B for more details.

2.2 Hypotheses

We have three testable null hypotheses about how (perception of) ranks and gender composition affect allocation decisions. When previous findings from related studies are generally mixed, we lay out our hypothesis on no effects.

Hypothesis 1 (No Last-Place Aversion)**.** *Fifth-ranked subjects are equally likely to allocate downwards than subjects holding ranks 2, 3, and 4.*

Hypothesis 1 is inspired by the previous findings on LPA. Using random assignment of ranks in every round, Kuziemko et al. (2014) provide supporting evidence for LPA, rejecting this hypothesis, while Camerer et al. (2016) and Martinangeli and Windsteiger (2021) provide opposing evidence for LPA. Our experimental setting is not directly comparable because the ranks in our experiment are not entirely random. However, we believe that the considered environment providing noisy feedback (rank) based on performance and luck is more aligned to the relevant situation for LPA than a mere random assignment of ranks, so we set our null hypothesis to check LPA.

Hypothesis 2. *Information about the genders of the Rank-Above and the Rank-Below does not affect the individual's tendency for redistribution.*

Hypothesis 2 states our null hypothesis on the effect of gender composition. As described in the Literature Review section, our conjectures on the effect of gender information on allocation decisions are mixed.

Hypothesis 3. *Subjects who believe their performance-based rank was higher than the announced rank tend to distribute downward less often.*

Hypothesis 3 states how the subjects' sense of "deservedness" affects their allocation decisions. When a subject feels that he is "under-placed," that is, his performance-based rank is higher than the announced rank, he believes that the luck factor negatively affects his payoff. This sense, in turn, might bolder the concern for the relative rank to drive him to allocate upward, to keep his current (still not satisfying) relative rank.

2.3 Procedures

The experimental sessions, conducted in November 2021 and January 2022, included participants recruited from the Mannheim Laboratory for Experimental Economics (mLab) of

the University of Mannheim. Invitations were sent to the members of the subject pool who had already provided their gender information in the recruitment system. Instructions were provided in English. Due to COVID-19 restrictions, we did not take participants to the laboratory. Instead, we invited them to join an online meeting to receive instructions from the experimenter, distributed the unique link for participating in the online experiment, and paid them via online transfers (either PayPal or bank transfer). Six sessions with 18 participants (9 females and 9 males) were conducted, so a total of 108 subjects participated in the experiment. We used an interactive online platform called LIONESS (Live Interactive Online Experimental Server Software, Arechar et al., 2018). After the subjects joined an online meeting, the experimenter disabled their profile photos and asked them to turn off the webcam. Furthermore, the subjects were asked to rename their displayed names to two letters they arbitrarily chose so that their identities, hence decisions, remain anonymous to the experimenter as well as other subjects. Subjects were asked to carefully read the instructions for each part of the experiment displayed on their screens and to pass a comprehension quiz.

The average payment per participant was 10.33 euros. Payments were made via online transfers after receiving the personal payment code generated at the end of the experiment. Each session lasted for less than 40 minutes.

3 Results

We first summarize the performance in Part 1. On average, each subject correctly decoded 24.79 text sequences (SD 3.93). Since the minimum and maximum performances were 15 and 36, there is a nonzero probability that the highest-performing subject could be ranked lower than the lowest-performing subject. The correlation between the ranks based on adjusted performance and those based on actual performance is 0.4065 ($p < 0.001$), which means that the luck factors perturbed the relative rank of the group members to some extent, yet the rank of actual performance significantly affects the relative rank.

As intended, there was no gender difference in performance. The average number of correctly-decoded text sequences is 24.76 (SD 3.78) for females and 24.81 (SD 4.11) for males, and the difference is not statistically significant (Kolmogorov-Smirnov (KS) test, $p = 0.60$; Mann-Whitney (MW) test, $p = 0.90$). The distribution of ranks based only on actual performance is not statistically different by gender (KS, $p = 0.59$; MW, $p = 0.90$) either. Thus, we claim that the findings we report are not driven by the gender difference in

the ability to perform in Part 1.

3.1 The effects of rank and gender composition

Figure 2 shows the proportion of the decisions allocating the additional money to the Rank-Below, collated by rank. Trivial decisions from rank 1 and rank 6 subjects are excluded as they have only one option to allocate money. For all ranks, the majority (80.83%) of the subjects prefer to sacrifice their relative rank by allocating money to the Rank-Below. Thus, subjects tend to prioritize inequality over rank concerns. This tendency is slightly more pronounced for females: 83.05% of female participants allocate downwards, and 78.69% of males do so, but the difference is not statistically significant ($p = 0.51$). Another notable finding is that we do not observe LPA. Although statistically insignificant, we observe the opposite: The subjects at rank 5 allocated the additional money to the Rank-Below more often than subjects at any different rank.

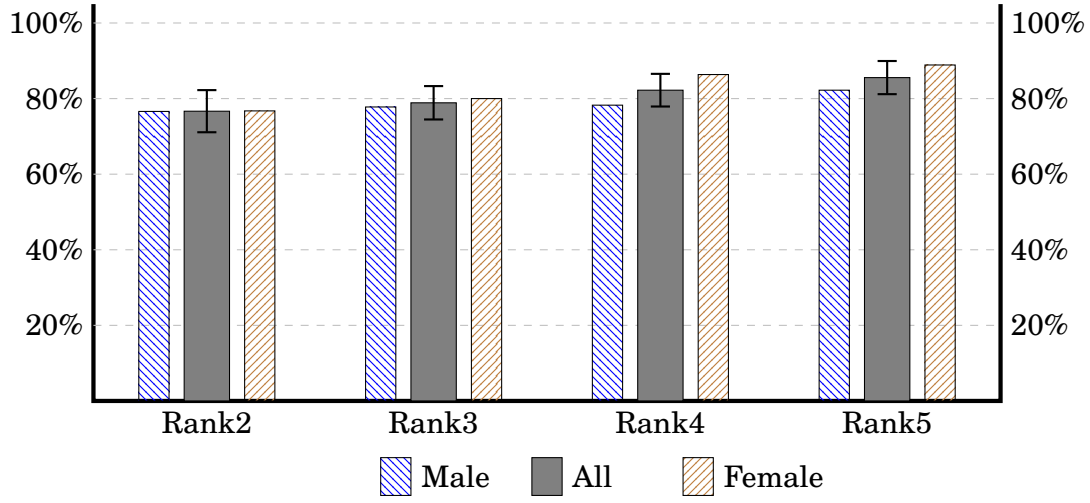

Figure 2: Proportions of allocating downward, by rank
The error bars represent standard errors clustered at the individual level.

Unlike for rank, we find significant effects of the gender composition of the Rank-Above and the Rank-Below on the allocation decision. From the perspective of the member at rank $r \in \{2,3,4,5\}$, when both members at rank $r-1$ and $r+1$ have the same gender as member r, we call it the *same-gender* (SG) situation. When both the Rank-Above and Rank-Below members have the different gender from member r, we call it the *mixed-gender* (MG) situation. When the Rank-Above member has the same gender as member r, and the Rank-Below has the different gender from member r, we call it the *same-above* (SA) situation. The

other situation is analogously called the *same-below* (SB) situation.[12]

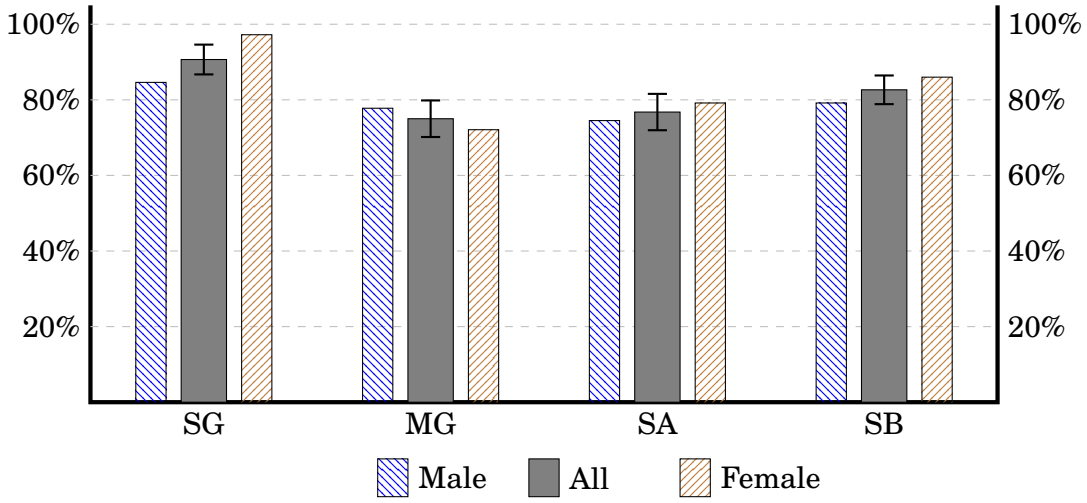

Figure 3: Proportions of allocating downward, by gender composition
SG/MG=rank $r-1$ and $r+1$ have the same/different gender.
SA/SB=the rank above/below has same gender.

Figure 3 shows the proportions of decisions allocating the additional money to the Rank-Below. Compared to other situations, there is a distinct tendency to allocate the money to the Rank-Below in SG (t-test[13], $p = 0.005$). The proportion of allocating downward in MG is the lowest, which is not statistically different from that in SA ($p = 0.895$). The proportion of allocating downward in SB is slightly larger than that in MG, but the difference is not statistically significant ($p = 0.151$) either. These observations imply that the subjects were more inclined to allocate the money to the Rank-Below, especially when the recipient of the money and the Rank-Above have the same gender. Moreover, this tendency of allocating the Rank-Below is driven by the behavior of female subjects. In SG, almost every (97%) female allocated the money to the female below-rank subject, while 85% of male subjects did it to the male below-rank subject.[14]

[12]Since the subjects are asked to consider two adjacent subjects, we believe that it is appropriate not to differentiate the situations further with respect to the gender composition of subjects at remote ranks. Although the contexts are somewhat different, Fisman et al. (2020) report that experimental subjects are locally competitive, preferring to decrease the income level directly above them, but not two positions above. This evidence suggests that the gender composition of the subjects two or more ranks away would not lead to noticeable differences.

[13]Unless otherwise stated, we report the p value of an estimated coefficient of a linear regression model controlling for ranks. The standard errors for the test statistics are clustered at the individual level. For regression results, including Probit regression results that are unreported in the main context, see Appendix B.

[14]This observation might be due to in-group bias based on gender: Rudman and Goodwin (2004) report that

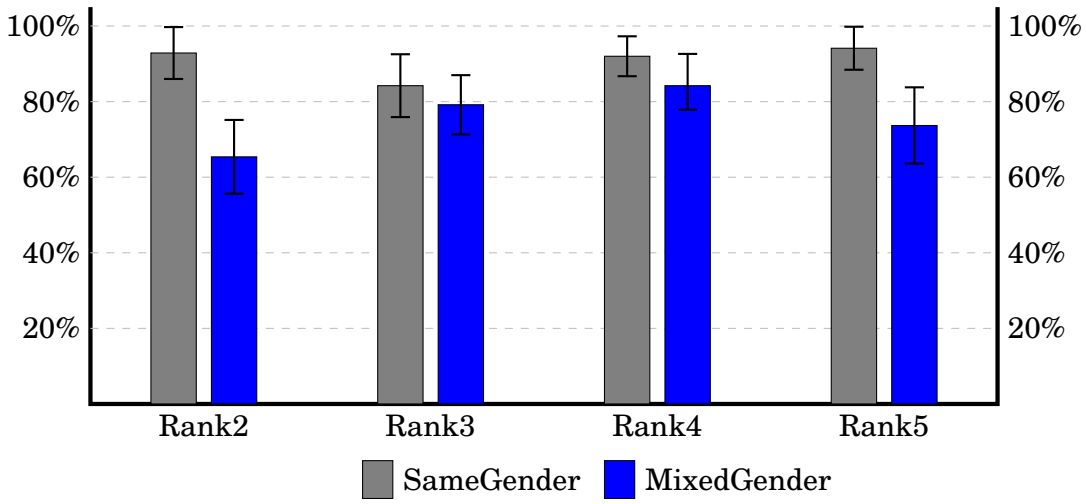

Figure 4: Proportions of decisions allocating the Rank-Below in SG and MG, by rank

Focusing only on SG and MG, we find that subjects at rank 2 and rank 5 allocate downward less often in MG. Figure 4 shows the proportions of allocating downward in SG and MG, collated by rank. The subjects holding ranks 2 and 5 allocated the additional money to the Rank-Below significantly more frequently when the adjacent subjects had the same gender ($p = 0.001$). This difference is more distinctive for females ($p = 0.014$) than for males ($p = 0.048$)[15]: Many second-ranked and fifth-ranked female subjects were reluctant to bring a one-rank-below man to the same rank as her. Although the differences at rank 2 and rank 5 are similar, our preferred interpretation is that the reluctance of subjects ranked second to allocate downward might be related to the mixed-gender first-place loving (Gill et al., 2019), while that of the fifth rank might be related to the mixed-gender last-place aversion (Kuziemko et al., 2014). When a second-ranked female allocates money to the first-ranked male, her decision does not alter her perception that she is at the top among females and two males are clearly behind her, but allocating downwards will compromise such perception because doing so makes two out of three males get paid as at least much as her. On the contrary, a fifth-ranked female perceives that she is at the bottom among females. Allocating downward would exacerbate the sense of being in the last place, so she would be

women tend to be more favorable to other women than men to other men. On the other hand, given that the patterns of the overall observations are weak but similar for men, this observation might indicate that women are more sensitive to the experimental context, as reported in Croson and Gneezy (2009); Miller and Ubeda (2012), for example.

[15]When separately examining the effect for (1) the male subjects holding rank 5, (2) the male subjects holding rank 2, (3) the female subjects holding rank 5, and (4) the female subjects holding rank 2, the effect is statistically significant only for the last case. However, there are only a few (16 to 20) observations per case, so we pooled the observations for ranks 2 and 5.

reluctant to do so.

3.2 Perceptions of Performance and Allocation Decisions

We now report the relationships between the allocation decisions and the post-experiment survey answers, including confidence in their performance and perceptions of luck. First, the subjects were generally overconfident about their actual performance rank: The average difference between the guessed performance rank and the actual performance rank among 18 subjects per session is 1.68 (SD 5.58), and the difference is statistically significant (t-test, $p = 0.002$). Male subjects were more overconfident than female subjects about their actual performance rank.[16] Figure 5 shows the empirical cumulative distribution functions of the actual performance rank by session and the perceived performance rank. Male subjects' guesses first-order stochastically dominate the actual ranks, implying that men were overconfident regardless of their actual performance. Female subjects were also overconfident, but the magnitude is much smaller, and some high-performing females were less confident about their relative performance rank. On average, male subjects guessed that their relative performance rank was 2.5 ranks (SD 5.40) better than their actual rank, while female subjects guessed that their rank was 0.85 ranks (SD 5.67) better. The overconfidence between males and females differs significantly ($p = 0.054$, controlling for actual performance rank).

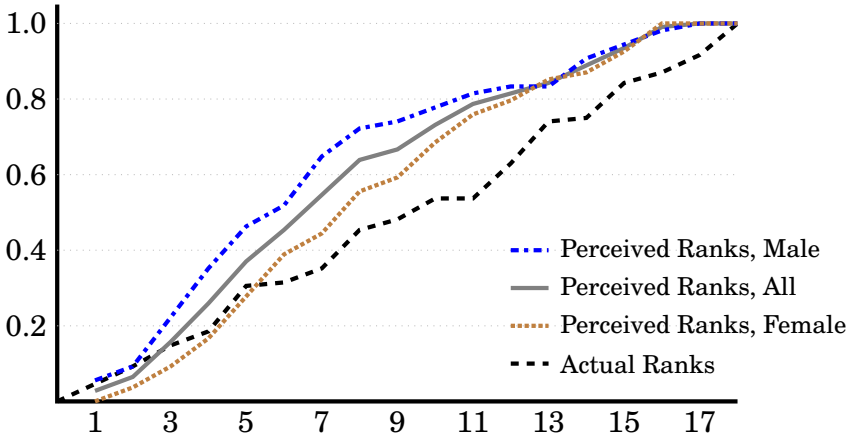

Figure 5: Empirical cumulative distribution functions for relative ranks

Moreover, we also notice that the subjects whose performance was worse tend to guess

[16] This finding is in line with Niederle and Vesterlund (2007), for example, who find that men are more overconfident about their relative performance in a math task, although they find no significant gender difference in actual performances.

their relative rank better in a more significant manner: When the actual rank increases by 1,[17] the gap between the actual rank and the guessed rank increases by 0.74 on average ($p < 0.001$). Combined with the gender difference in the perception of their relative performance rank, this observation suggests that the low-performing male subjects are more likely to believe that their rank displayed on their screen—hence the allocation of money—is worse than what they feel deserved. This conjecture leads us to examine the LPA for the males only: If a male subject learns that his rank is 5 out of 6, he might feel that the rank is significantly worse than his performance rank, and this thought might drive him not to allocate money to the Rank-Below. It is indeed the case that the fifth-ranked male subjects in MG allocate to the Rank-Below less often than the males holding ranks 2, 3, and 4. However, the difference is statistically insignificant ($p = 0.261$).

3.3 Perceptions of Luck and Allocation Decisions

During the post-experiment survey, we asked the subjects to evaluate the following three statements on a 1–5 Likert scale :

1. "I feel that, overall, the random adjustment of the performance places me worse ranks than my actual ranks."

2. "I feel that the effect of random adjustment on the relative rank is stronger than that of actual performance."

3. "A society should accept inequality caused by differences in luck."

The first question asks how strongly they feel about the negative impact of luck on their payoffs. We use this question for a validity check of the survey answers. If the subjects strongly agree with the statement, then they would report their performance rank better than the rank from Part 2, and thus, the difference between the actual performance rank and the perceived performance rank would increase. Confirming this narrative, we find a strong and positive correlation between them (ρ=0.2160, $p < 0.001$).

The second question asks about the perceived importance of the luck factor. As described, we aimed for the actual performance and the luck factor to have an equal impact on the rank of adjusted performance. We examine whether subjects who felt that the luck factor's impact

[17] Since the subject with the best performance is ranked first (1) and the one with the worst performance is ranked last (18), an increase in rank means that the relative rank falls. We are aware of this potential confusion, so we clarified the meaning of it to the experiment participants.

was strong behave differently from those who did not. We find that male subjects more often than females agree that the luck factor's impact was stronger than the actual performance (KS, $p = 0.017$), echoing the above-reported higher overconfidence of males. Besides that, we find that the perceived importance of the luck factor does not affect the allocation decisions in any way. The last question asks about the general attitude of accepting the inequality caused by differences in luck. Interestingly, we find that the subjects who more strongly agree with the statement allocate the additional money to the Rank-Below less often ($p = 0.061$). From the perspective of a subject, allocating downward involves giving up one's rank for mitigating inequality. Our preferred interpretation for this observation is that those who embrace the luck-driven inequality would be less inequality-averse and put relatively more weight on their concern for relative rank.

4 Conclusions

We add another layer—gender composition—to the existing studies about the concerns for relative rank and distributional outcomes. We hypothesized that decision makers' weightings between the concern for the relative position and the equality of outcomes might depend on the gender of potentially affected persons. Thus, the gender composition of reference groups could affect their allocation decisions. However, there is no clear indication whether people are relatively more or less sensitive to rank concerns when affected persons are of the same or the opposite gender. This uncertainty motivates our study.

We let the experiment participants encounter different payoff-relevant ranks, innocuously provide gender information of others, and ask them to allocate additional money to a person at one rank below or above. The crucial variation is whether the person at one rank below (the Rank-Below for short) is of the same gender. When the Rank-Below has a different gender, allocating downward does not alter the within-gender rank. It turns out that the experiment participants allocate downward more often when the Rank-Below is of the same gender. This tendency is more distinctive when the person at one rank above (the Rank-Above for short) also has the same gender, especially among women. We interpret that solidarity is higher among women. Allocating money to a female Rank-Below minimizes inequality among three women, while allocating money to a female Rank-Above exacerbates income differences.

Meanwhile, we do not find any support for Last-Place Aversion (LPA). The subjects at the fifth rank (one rank above the bottom) allocated money downward as much as the subjects

at different ranks did. Joint with the finding on same-gender solidarity, these results indicate that gender composition matters for allocation decisions when facing a rank-inequality tradeoff, potentially more than the overall rank.

Future research is needed to investigate many underexplored questions on the tradeoff between the concern for the relative rank and the distributional outcome. For the current study, the subject's performance and luck are similarly attributed to determine the observed ranks, but it would be worth investigating the effects of different rank-determining schemes ranging from pure luck to pure performance. The effects of the group size and the varying degree of income inequality relative to the magnitude of redistribution could also be investigated.

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A Appendix - Experimental Instructions

Thank you for your participation. Before moving on to the main experiment, please complete a short survey.

[Ask participants' gender, age, a field of study, and experience of online experiments.]

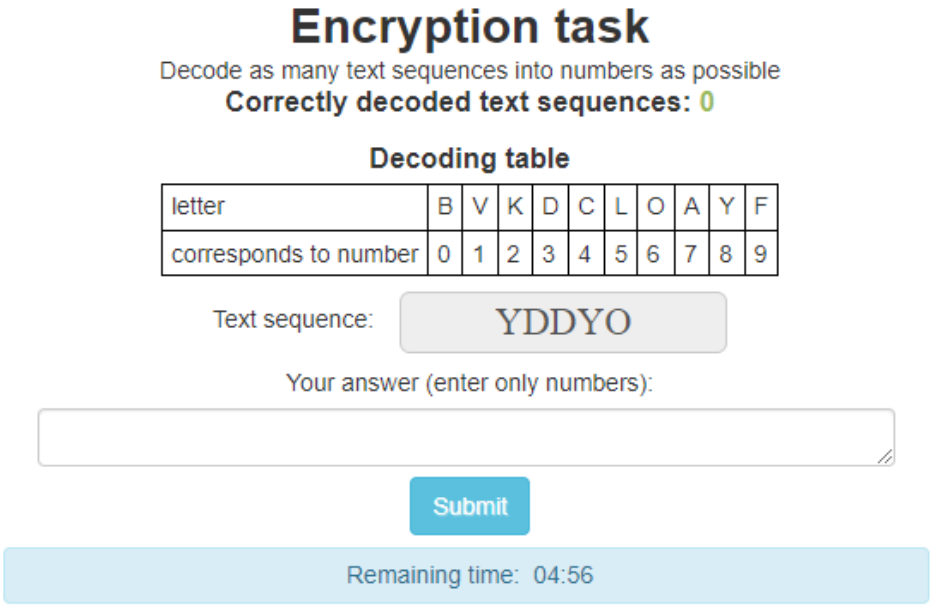
In this experiment, your earnings will be based on your decisions, others' decisions, and some luck. It is important that you fully understand the following instructions. Please read them carefully.

Overview

This experiment mainly consists of two parts. In Part 1 of the experiment, which we call WORKING, you will work on a task for 5 minutes. In Part 2 of the experiment, which we call DECISIONS, you will report your decisions under a given situation. Your earnings in this experiment will depend on both—your task performance and random factors. More details follow.

Part 1: WORKING

You will perform a so-called Encryption Task. Specifically, you will read sequences of random letters. These have to be **decoded into numbers** with the given decoding table. For each text sequence, the decoding table changes. Below is an example of such a sequence.



In the example, you can see the text sequence *YDDYO*. The decoding table tells you that B=0, V=1, and so on. This means that you have to decode *YDDYO* into *83386* and enter this numeric value into the answer field.

You will have **5 minutes** to correctly decode as many text sequences into numbers as possible. Note that each letter must be decoded correctly. After entering the decoded text sequence, hit the submit button. Subsequently, irrespective of whether the text sequence was decoded correctly or not, a new text sequence and a new decoding table will appear. You will see the remaining time in the upper right corner of the screen. **The more correct answers, the more money you will earn.** We will provide you more detail in the second part of the experiment.

Quiz Please answer the following two questions. If you answer one or more questions wrongly, you have to re-take the quiz.

Q1 What is the aim of the task? (A) Write meaningful words from the given letters. (B) Decode the letters into numbers. (C) Reorder the letters according to the alphabet. (D) Assign a value to each letter and calculate the total value.

Q2 Which of the following statements is **false**? (A) For each text sequence, the decoding table changes. (B) The answer only contains numbers. (C) Regardless of whether you decode the sequence correctly, a new text sequence will appear. (D) You have as much time as you want to decode the text sequences.

[Subjects perform the real-effort task for 5 minutes.]

Part 2: DECISIONS

This part of the experiment consists of 5 rounds. At the beginning of each decision round, we want you to pick your nickname among the list of alternatives. This way, you and others are completely anonymous, yet you can clearly distinguish other subjects by their nicknames. (Everyone receives different options, so do not worry about possible duplication within a decision round. If you see the same names in other rounds, it is the result of pure coincidence, not implying the same person picking the same name twice.)

In each round, after you pick your nickname, a computer randomly assigns you to a group of six and displays your and other group members' **relative rank.** The rank is determined by your performance within Part 1 (WORKING) **and the unknown outcomes of a dice roll**. Specifically, the rank is determined as follows.

1. After the computer rolls a dice, the "adjusted performance" is determined. For simplicity, let N denote the number of correct answers in Part 1.

    - If your dice roll is 1, then your adjusted performance is $3 \times N$.

- If your dice roll is 2, then your adjusted performance is $4 \times N$.
- If your dice roll is 3, then your adjusted performance is $5 \times N$.
- If your dice roll is 4, then your adjusted performance is $6 \times N$.
- If your dice roll is 5, then your adjusted performance is $7 \times N$.
- If your dice roll is 6, then your adjusted performance is $8 \times N$.

So, for example, if you have 10 correct answers in Part 1, your adjusted performance could vary from 30 to 80.

2. The relative rank shows the rank of the adjusted performance, not the rank of the actual performance.

3. You will not learn the realizations of dice rolls.

For illustration, suppose that your rank is higher than the rank of another member. A higher rank could mean (1) that your performance in Part 1 (WORKING) was better than her, or (2) that your dice roll outcome was higher than her. When your adjusted performance happens to be the same as another member's, a computer randomly determines who receives the higher rank.

In each round, you and your group members will receive different amounts of money according to the ranking. The person ranked first will receive 15€, the person ranked second will receive 13€, the person ranked third will receive 11€, and so on.

After you observed the initial money amounts, everyone will be asked to choose who should get more money. The additional money comes from an **external source** and does not take away from the amount of money you have. The choices you make are private and will not be shown to anyone playing the game.

Once everyone in your group has decided, the computer will randomly select one group member and award the additional money according to the selected member's decision. At that point, the computer records everyone's updated earnings, but it will not show your final earnings from the round.

For every new round, all participants are reshuffled, and you are randomly assigned to a new group of six. The computer rolls new dices for the new round, which are independent of the previous outcomes. The new ranking is then determined based on your performance within Part 1 (Working), your new group members' performance, and the new dice rolls.

Payment

At the end of the experiment, the server computer will randomly select one of the five rounds with equal probability. Your final earnings in that selected round will be your actual payment. Since each round is equally likely selected, it is in your best interest to take every round equally seriously.

Quiz

Please answer the following two questions. If you answer one or more questions wrongly, you have to re-take the quiz.

Q1 Suppose Adam and Bea are in the same group. Adam solved 10 tasks and Bea solved 11 tasks within Part 1 (WORKING). Which of the following statements is **false**? (A) The "adjusted performance" of Adam could range from 11 to 16. (B) Bea will hold a better rank than Adam in any case. (C) If their dice rolls are equal, Bea will hold a better rank than Adam. (D) If Bea holds a better rank than Adam, she will initially receive a higher amount of money.

Q2 Which of the following statements is **true**? (A) Your nickname will remain the same during all five rounds. (B) At the end of each round, the choices of all group members are implemented. (C) Your group members will remain the same during all five rounds. (D) The additional money you are asked to give to another group member comes from an external source.

[Subjects make redistribution decisions for 5 rounds. See Figure A1 for illustration.]

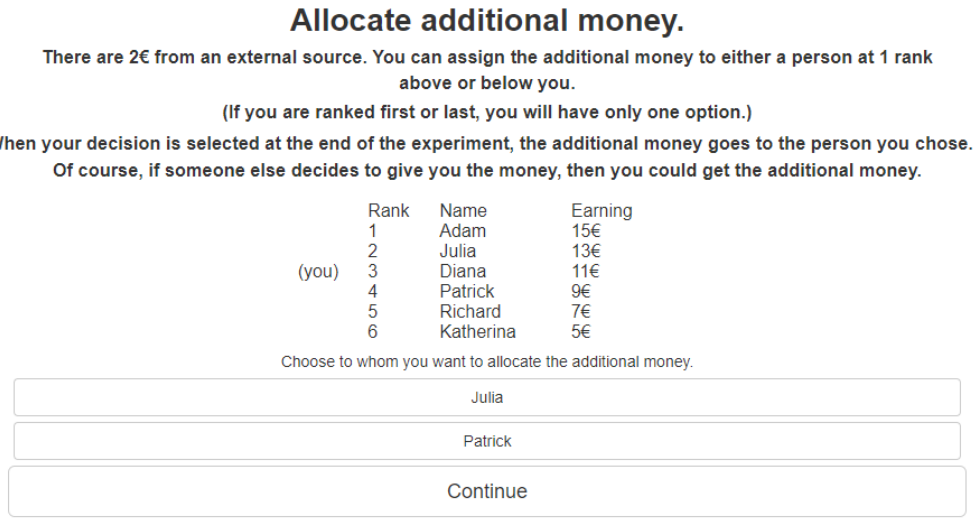


Figure A1: Screenshot of Part 2

[Subject filled out post-experimental survey questions.]

Survey

1. There were 18 (including you) in the experiment you just finished. Please give your best guess about your actual rank of the performance. (Write an integer between 1 and 18.)

2. Please specify how you agree on the following statement: "I feel that, overall, the random adjustment of the performance places me worse ranks than my actual ranks."

3. Please specify how you agree on the following statement: "I feel that the effect of random adjustment on the relative rank is stronger than that of actual performance."

4. Please specify how you agree on the following statement: "A society should accept inequality caused by differences in luck."

B Appendix - Regression results

	OLS			Probit		
	(1) Pooled	(2) Females	(3) Males	(4) Pooled	(5) Females	(6) Males
rank2	-0.0889	-0.121	-0.0563	-0.333	-0.490	-0.198
	(0.0669)	(0.101)	(0.0919)	(0.249)	(0.393)	(0.324)
rank3	-0.0667	-0.0889	-0.0444	-0.258	-0.379	-0.159
	(0.0482)	(0.0740)	(0.0649)	(0.192)	(0.323)	(0.237)
rank4	-0.0333	-0.0253	-0.0396	-0.137	-0.124	-0.143
	(0.0542)	(0.0604)	(0.0884)	(0.223)	(0.296)	(0.321)
_cons	0.856^{***}	0.889^{***}	0.822^{***}	1.061^{***}	1.221^{***}	0.924^{**}
	(0.0467)	(0.0531)	(0.0778)	(0.204)	(0.278)	(0.296)
N	360	177	183	360	177	183

The dependent variable is a dummy indicating whether a subject allocated downward. Observations holding ranks 1 and 6 are omitted. Standard errors clustered at the individual level are in parentheses.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table B1: Rank effects

	OLS			Probit		
	(1) Pooled	(2) Females	(3) Males	(4) Pooled	(5) Females	(6) Males
SG	0.157**	0.251**	0.0684	0.646*	1.329*	0.255
	(0.0568)	(0.0909)	(0.0663)	(0.259)	(0.516)	(0.266)
SA	0.0177	0.0707	-0.0327	0.0567	0.227	-0.106
	(0.065)	(0.109)	(0.0755)	(0.208)	(0.344)	(0.24)
BS	0.0765	0.139	0.0139	0.266	0.495	0.0475
	(0.0533)	(0.0795)	(0.0742)	(0.182)	(0.26)	(0.253)
_cons	0.750***	0.721***	0.778***	0.674***	0.586*	0.765***
	(0.0513)	(0.0847)	(0.0601)	(0.161)	(0.25)	(0.2)
N	360	177	183	360	177	183

The dependent variable is a dummy indicating whether a subject allocated downward. Observations holding ranks 1 and 6 are omitted. Standard errors clustered at the individual level are in parentheses.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table B2: Effects of gender composition

	OLS			Probit		
	(1) Pooled	(2) Females	(3) Males	(4) Pooled	(5) Females	(6) Males
rank2	-0.0849	-0.109	-0.0561	-0.322	-0.468	-0.194
	(0.0632)	(0.0921)	(0.0910)	(0.239)	(0.377)	(0.319)
rank3	-0.0737	-0.0884	-0.0527	-0.299	-0.429	-0.188
	(0.0486)	(0.0744)	(0.0676)	(0.197)	(0.329)	(0.249)
rank4	-0.0474	-0.0401	-0.0505	-0.202	-0.191	-0.182
	(0.0556)	(0.0612)	(0.0911)	(0.231)	(0.305)	(0.327)
SG	0.152**	0.240**	0.0685	0.636*	1.313**	0.263
	(0.0551)	(0.0876)	(0.0660)	(0.257)	(0.501)	(0.271)
SA	0.00924	0.0557	-0.0364	0.0289	0.161	-0.110
	(0.0652)	(0.110)	(0.0764)	(0.209)	(0.353)	(0.238)
SB	0.0746	0.129	0.0168	0.262	0.460	0.0643
	(0.0518)	(0.0759)	(0.0736)	(0.175)	(0.251)	(0.243)
_cons	0.805***	0.789***	0.818***	0.898***	0.907**	0.904**
	(0.0552)	(0.0786)	(0.0812)	(0.208)	(0.297)	(0.290)
N	360	177	183	360	177	183

The dependent variable is a dummy indicating whether a subject allocated downward. SG, SB, and SA respectively refer to a *single gender*, *same above*, and *same below* situation. Observations holding ranks 1 and 6 are omitted. Standard errors clustered at the individual level are in parentheses.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table B3: Effects of rank and gender composition

	OLS		Probit	
	(1) SG	(2) MG	(3) SG	(4) MG
rank2	-0.0126	-0.0830	-0.0995	-0.238
	(0.0920)	(0.148)	(0.707)	(0.422)
rank3	-0.0991	0.0548	-0.562	0.179
	(0.0754)	(0.131)	(0.436)	(0.415)
rank4	-0.0212	0.105	-0.160	0.370
	(0.0815)	(0.141)	(0.617)	(0.493)
_cons	0.941***	0.737***	1.565**	0.634*
	(0.0594)	(0.104)	(0.496)	(0.312)
N	75	88	75	88

The dependent variable is a dummy indicating whether a subject allocated downward. SG and MG respectively refer to a *single gender* and *mixed gender* situation. Observations holding ranks 1 and 6 are omitted. Standard errors clustered at the individual level are in parentheses.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table B4: Rank effects in SG and MG

	OLS			Probit		
	(1)	(2)	(3)	(4)	(5)	(6)
rank2	-0.0888	-0.0871	-0.0948	-0.333	-0.319	-0.363
	(0.0672)	(0.0657)	(0.0676)	(0.249)	(0.244)	(0.257)
rank3	-0.0667	-0.0612	-0.0737	-0.258	-0.232	-0.281
	(0.0483)	(0.0471)	(0.0490)	(0.192)	(0.186)	(0.198)
rank4	-0.0334	-0.0272	-0.0241	-0.137	-0.105	-0.103
	(0.0537)	(0.0517)	(0.0531)	(0.221)	(0.213)	(0.221)
PL	-0.00123			-0.00599		
	(0.0250)			(0.0942)		
IL		0.0325			0.116	
		(0.0297)			(0.109)	
SL			-0.0487			-0.183
			(0.0258)			(0.0940)
_cons	0.860***	0.734***	0.982***	1.081**	0.628	1.558***
	(0.0890)	(0.107)	(0.0706)	(0.353)	(0.376)	(0.321)
N	360	360	360	360	360	360

The dependent variable is a dummy indicating whether a subject allocated downward. PL (Perception of Luck), IL (Importance of Luck), and SL (Society embracing Luck) respectively refer to the Likert-scale answers on survey questions 2–4. Observations holding ranks 1 and 6 are omitted. Standard errors clustered at the individual level are in parentheses.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table B5: Effects of post-experimental perceptions