Conflict and Migration: Mobility and Social Identity in Group Contests

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Abstract

Group contests have been used to study conflict between countries, R&D competitions, sports competition and lobbying. Usually, it is assumed that individuals belong to one group and that this group membership will remain unchanged. However, in practice, soldiers can defect, employees switch employers and athletes switch teams. In a lab experiment, we introduce intergroup mobility to a group contest and test how this affects contest contributions. We find that endogenous (voluntary) migration increases contest contributions, whereas exogenous migration (displacement) has a negative but only marginally significant effect relative to a baseline without intergroup mobility. Ingroup bias persists throughout the experiment in all treatments and does not decrease in the migration treatments. In the Endogenous Migration treatment, the decision to leave the own group is mainly driven by bad prospects of winning.

Keywords: Group Contest, Migration, Rent-seeking, Social Identity
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1 Introduction

"Ita amicum habeas, posse ut facile fieri hunc inimicum putes."
Treat your friend as if he might become an enemy
– Publilius Syrus (1st century BC), *Sententiae*

"Ex inimico cogita fieri posse amicum"
Consider that you may make a friend of an enemy
– Seneca (1st century AD), *Epistulae Morales ad Lucilium*

The European nations have waged war against each other for most of history. For over six decades, however, the European Union and its forerunners have experienced a lasting period of peace. In 2012, the European Union has even been awarded with the Nobel Peace Prize for overcoming the division between East and West, and settling many ethnically-based national conflicts (The Norwegian Nobel Committee, 2016). When asked, peace and freedom of movement are referred to by its citizens as the two most positive outcomes of European integration (Parliament and European Commission, 2017), with freedom of movement having been accredited for achieving this peace and building towards a common European identity (i.a. through the academic exchange programme *Erasmus*) (Sodha, 2016; Riotta, 2012).

Whether an increased (labour) mobility reduces conflict has been hard to establish empirically. Investigating this question using field data is difficult because dynamic interactions of migration and conflict are common, e.g. emigration caused by conflict.[1] In the lab however, we can create a controlled environment in which we can exogenously vary migration and thus can study the causal link between migration and conflict directly. In this study, we run a lab experiment in which two groups compete against each other for a prize in a group contest and vary the migration possibilities between groups.

Economists have used group contests to model conflict between countries, R&D competitions, sports competition and lobbying. In the contest game based on Tullock (1980) and Katz et al. (1990), groups compete against each other for a prize. In the Nash equilibrium, groups contribute resources to the conflict to increase the winning probability even though the contribution itself is lost and any positive contribution reduces overall welfare. While the equilibrium contest contributions described in the theoretical model are already wasteful, participants in experiments usually spend even more resources on the conflict

[1] See e.g. Collier and Hoeffler (2004) for a discussion of the link between diasporas/emigration and the risk of civil war.

than what is expected from a risk-neutral individualistic agent (Dechenaux et al., 2015; Sheremeta, 2018). The explanations for this waste of resources include amongst others joy of winning, relative payoff maximisation, and impulsivity (Sheremeta, 2013). However, as these explanations equally apply to individual contests, they do not explain why contributions in group contests tend to be even higher than in individual contests (see e.g. Abbink et al., 2010).

An explanation for overbidding that is specific to group settings is social identity. Zaunbrecher and Riedl (2016) show that adopting the social identity model from Chen and Li (2009) and Chen and Chen (2011) to the group contest implies higher contest contributions for groups with a strong identity than for those without. Zaunbrecher et al. (2021) show that the group contest setting itself already induces a strong group identity which would thus induce a higher waste of resources. Cason et al. (2012) find that communication results in higher contest contributions and suggest that this might be the result of communication strengthening group identity. Similarly, Chowdhury et al. (2016) have shown the escalating effect of primed natural identities on group contests.

Most of this research on group contests has been done with fixed groups. However, in naturally occurring group contests it is often possible, or even common, to move between groups. For instance, employees change employer or teams within a firm, citizens emigrate to other countries, and athletes change clubs, all of which leads to less rigid group boundaries than are usually used in the lab. Tajfel and Turner (1979) suggest that having less rigid group boundaries could result in dissociation from the group and more selfish behaviour and Akerlof and Kranton (2000) stress the importance of exlcusion as a mechanism in social identification. Thus having more permeable boundaries could result in lower identification with the group.

Evidence from public good games suggests that changing group composition can lead to a decrease in cooperation (e.g. Grund et al., 2015, 2018). Conversely, the literature on endogenous groups suggests that letting participants choose the group they play with can lead to more efficient outcomes, especially if entry to the group can be restricted or sanctioning institutions are available (e.g. Ahn et al., 2009; Charness and Yang, 2014; Gürerk et al., 2006, 2014; Riedl et al., 2016; Chen, 2017). To our knowledge there have been no studies that investigate the difference between fixed and changing teams in group contests. There is some theoretical and experimental literature on coalition formation and contests, where it has been shown that endogenous coalition formation can increase conflict (Bloch, 2012; Herbst et al., 2015; Smith et al., 2012), however the focus of those studies lies on the group formation process, coalition stability, and self selection into groups rather than migration between different groups and group conflict.

We run a lab experiment with three treatments in which eight participants repeatedly compete against each other in two groups to win a prize. In the Control treatment, groups remain unchanged for the whole experiment. In the Endogenous (voluntary) Migration treatment, participants can decide to leave their group after each round. Per pair of competing groups two "stay or leave" decisions are randomly selected to be implemented. In the Exogenous (displacement) Migration treatment, we implement migration decisions from the Endogenous treatment. This guarantees the same game paths in terms of group sizes in the Endogenous and Exogenous Migration treatments. To shed light on the potential mechanisms at work, we measure Social Value Orientation (SVO) towards the ingroup and the outgroup before and after the contest. Furthermore, we elicit beliefs about the average individual contribution of the own group and the other group in each round. Because migration has the effect that the enemy of today can be a friend tomorrow and vice versa, we hypothesise that allowing migration weakens group identity. In terms of a social preferences model of social identity, this means that participants put less weight on the payoffs of their current group members which in turn decreases their contest contributions. Furthermore, migration between the groups could increase the weight participants put on the payoff of the opposing groups' players, treating enemies of today as potential friends of tomorrow which may also lead to a decrease in contributions.

In the Endogenous Migration treatment, migration decisions also contain a signalling value, though. While it is still true that there is uncertainty about the future composition of the own and other group which could decrease contributions, this might be counteracted by asymmetric social identity effects. A migration taking place signals to the group that receives a new member that they are more desirable than the opponent, potentially strengthening social identity and increasing contributions. To the group that lost a member it sends a signal that they are not desirable, potentially weakening social identity and decreasing contributions. The overall effect of the migrations could thus be ambiguous. The Exogenous Migration treatment allows to abstract from these alternative explanations and isolate the effect of migration on contest contributions.

We find that contest contributions are higher in the Endogenous (voluntary) Migration treatment than in the Control treatment but this effect is only significant once we control for both group size and previous contributions. Comparing only the two migration treatments shows that contributions are significantly lower in the Exogenous Migration (displacement) treatment. When we consider actually implemented migrations, we find heterogeneous effects. Migrations in the Exogenous treatment result in increasing contributions but the opposite happens in the treatment with endogenous migration. Despite the changing group compositions that the migrations engender, we do not observe that ingroup bias – as measured by social value orientation – changes between the start and end of the contest and does also not differ between treatments. An exploratory analysis of the migration decision in the Endogenous treatment suggests that participants' prospects of winning are the strongest driver for the migration decision.

The implications of our findings depend on the context to which the model is applied. From the perspective of a social planner, the results suggest that migration does little to alleviate conflict between groups and endogenous migration might even further escalate conflict. For sports teams, companies, and perhaps even countries, on the other hand, our results suggest that migration does not decrease identification with the own group and does not decrease the competitiveness of the own group.

The remainder of the paper is structured as follows. First, we introduce our experimental design. Second, we discuss our predictions and hypotheses. Third, we present the empirical analysis of the experimental data. Fourth, we provide a discussion of our findings.

2 Experimental Design

The experiment has three stages. At the beginning of stage one, participants are randomly matched into groups of four and perform two social preference elicitations with respect to an ingroup and an outgroup member. In the second stage, they compete in a group contest for 15 rounds. Depending on the treatment, they are either in fixed groups, have the possibility to migrate, or might be forced to migrate during the contest. In the third stage, they perform two additional social preference elicitations with respect to an ingroup and an outgroup member and fill in a short questionnaire. In the following, we introduce the social value orientation test used to elicit social preferences and the structure of the contest game, before we elaborate on the different treatments and the procedures.

2.1 Social Value Orientation

Before and after the group contest, participants perform two social value orientation (SVO) tests, one with respect to an ingroup member and one with respect to an outgroup member. The SVO tests are based on the slider measure developed by Murphy et al. (2011) and are an efficient and parametric implementation of the SVO ring measure previously conceptualised by Griesinger and Livingston

(1973) and Liebrand and McClintock (1988). The test itself consists of six modified dictator games in which participants divide money between themselves and another person. The six budget sets of the dictator games vary the cost of giving, such that giving money to the other participant is either costly, free, or profitable for the giver. Table 1 shows the end points of the budget sets and the associated relative price of giving. The end points represent pure altruistic, prosocial, individualistic, and competitive preferences, respectively.

Table 1: SVO Budget Sets

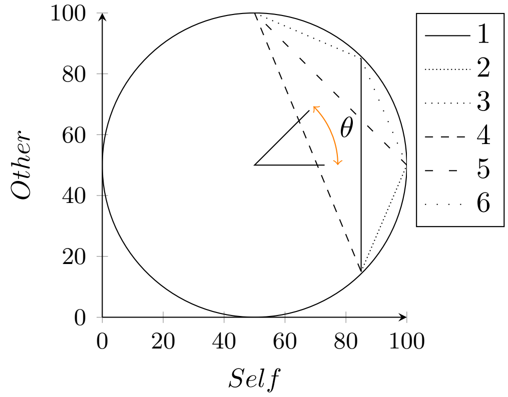
Budget Set	Option 1 $(\pi_{self}, \pi_{other})$	Option 9 $(\pi_{self}, \pi_{other})$	Relative price of giving $-(\Delta\pi_{self}/\Delta\pi_{other})$
1	(85, 85)	(85, 15)	0
2	(85, 15)	(100, 50)	-0.43
3	(50, 100)	(85, 85)	2.33
4	(50, 100)	(85, 15)	0.41
5	(100, 50)	(50, 100)	1.00
6	(100, 50)	(85, 85)	0.43

Note: The budget sets represent the six items of the SVO slider measure. Option 1 and Option 9 represent the start and endpoint of a budget constraint in the self-other allocation space. Participants choose a point on the budget constraint that is a linear combination of Option 1 and 9 for each budget set. The relative price of giving represents the trade-off between own payoff and payoff of the other person for each of the budget sets. E.g. for budget set 3, increasing the payoff to the other by one unit decreases the own payoff by 2.33 units.

The allocation decisions are then aggregated into the social value orientation angle $SVO^\circ = \theta = \arctan\left(\frac{(\bar{A}_o - 50)}{(\bar{A}_s - 50)}\right)$, where $\bar{A}_o$ is the average allocation to the other person and $\bar{A}_s$ is the average allocation to the self. 50 is subtracted from both averages to center the angle within the SVO ring in the self-other allocation space. This provides us with a continuous measure of social preferences (Figure 1). From the difference between the *own* group and *other* group SVO we construct the ingroup bias which is our measure for the strength of social identity.

2.2 Group Contest

The contest game between two groups A and B implemented in the experiment is structured in the following way: Each player receives an endowment of $e = 120$ and decides independently and simultaneously with the other players how much of the endowment to contribute to the contest game. Endowment that is not contributed is added to the player's private account. Contributions of



Note: The six budget constraints represent the six items of the SVO slider measure. The angle θ is the parameter that is calculated from the six points that players chose on the six budget constraints. The four points on the circle are the idealised allocation decisions that perfectly competitive, individualistic, prosocial or altruistic persons respectively would make. The theoretically possible SVO range resulting from the six budget sets is $-16.26°$ to $61.39°$.

Figure 1: SVO Budget Sets and SVO Angle in the Self-Other Payoff Space

members of group A are labelled a_i where $i \in A$, contributions of group B are defined analogously. Group sizes are labelled N_A and N_B and are equal to 4 for both groups in the Control but can vary in the migration treatments with the restriction that $N_A + N_B = 8$. In the following we explain the game from the perspective of someone from group A, the expected payoff for someone from group B can be derived analogously. For group A the probability of winning the contest is given by the total contributions of group A divided by the sum of total contributions of both groups:

$$p_A(\sum_{i \in A} a_i, \sum_{j \in B} b_j) = \frac{\sum_{i \in A} a_i}{\sum_{i \in A} a_i + \sum_{j \in B} b_j}.$$

If nobody contributes, the probability of winning is $\frac{1}{2}$. Each unit of contribution can be interpreted as a lottery ticket and after contributions are made, one ticket is drawn from the pool of lottery tickets to decide which group wins the contest. Thus, the more contributions are made by a group, the higher the chance to win the contest. The contest prize is $z = 1,920$ and is split equally amongst all group members of the winning group. Thus, if Group A is the winning group, every group member in A gets an individual payoff of $z/N_A = 1,920/N_A$. The expected payoff of a player $g \in A$ who contributes a_g is thus the endowment plus the expected individual payoff of winning the contest minus the contributions made by the individual group member g:

$$\pi_g(\sum_{i\in A} a_i, \sum_{j\in B} b_j) = 120 + \frac{a_g + \sum\limits_{i\in A\setminus g} a_i}{a_g + \sum\limits_{i\in A\setminus g} a_i + \sum\limits_{j\in B} b_j} \cdot \frac{1,920}{N_A} - a_g,$$

The group contest game is repeated for 15 rounds. In addition to contribution decisions, we elicit players' expectations about the average contribution in their own group and in the other group after they made their contribution decision. At the beginning of each round, players receive information about their group composition. After each round, players are informed about their own contribution, which group won, how much their own and the other group contributed, and what the probability of winning the contest was for their group.

2.2.1 Control Treatment

In the Control treatment, group sizes are fixed at size 4 and the group composition stays unchanged throughout the experiment. Therefore, participants compete with the same group members in all 15 rounds of the contest.

2.2.2 Endogenous Migration Treatment

The Endogenous Migration treatment is identical to the Control treatment except for that after each round, each of the players is presented with the choice to remain in their group or to move to the other group (i.e., to migrate). In each round, two of these eight decisions per group-pair are randomly chosen to be implemented.

If the player whose decision is selected, intends to migrate, this player will be transferred to the other group. If the player does not intend to migrate, she will remain in her group. Thus, at the end of a round, *one* of the following three situations could emerge: *two migrations*, *one migration*, or *no migration*.

To avoid confounds caused by group size effects, the probability for the own decision to be implemented is independent from the group size. Alternative setups would not guarantee this. For instance, one random decision per group instead of two random decisions per matched group-pair could be implemented. In that case, however, changes in group size would affect the probability that the own decision gets implemented. Similarly, we decided against randomly choosing two *migrations* instead of *migration decisions* as the probability that the own decision is executed would then depend on other players' migration decisions. One could also implement all migration decisions but this could result in situations in which all players migrate and thus the groups just switch sides but still have the same teammates.

2.2.3 Exogenous Migration Treatment

If players can freely choose to migrate, the migration decision can be interpreted as a signal that one group is rated higher than another. This can potentially change the strength of social identity in both groups, weakening the identity in the group that is losing a player and strengthening the group that receives an additional player. To disentangle if it is *migration itself* that drives behaviour or if it is the *intention and signal value*, we implement the migration decision exogenously in the Exogenous Migration treatment. Instead of letting players decide if they want to change groups or not, the migration pattern of each pair of groups from the Endogenous Migration treatment is implemented exogenously. This means that group sizes will develop in the same way as in the Endogenous treatment, which creates a comparable path dependency as in the main migration treatment but without the potential selection effects.

2.3 Payment and Procedures

At the end of the experiment, one of the 15 contest rounds is randomly selected and paid out. Additionally, participants receive a payment from the SVO tests as follows: Players are randomly matched with another player from their group-pair and it is determined if the SVO before or after the contest counts. One of the players in each match is chosen to be the dictator and the other one is the receiver. The matched players' group memberships will determine whether one of the dictator's ingroup or outgroup decisions will be paid out. Then, one of the six decisions of the dictator will be picked at random for payment. Players get the information which round was selected, how much they earned in that round, how much they earned from the social value orientation tests and how much they will get paid out in total.

The experiment was conducted at the CentERlab of Tilburg University in September and November 2017 and took about 90 minutes.[2] There were a total of 15 sessions, and treatments were partly randomised within session.[3] The tokens earned in the experiment were exchanged at a rate of 20 $tokens = 1$ $Euro$. In total we recruited 240 participants, 80 per treatment, who earned an average of 17.43 Euro (20.54 Dollars at 28th September exchange rate). This resulted in 10

[2]Instructions can be found in Appendix A.

[3]Because of varying show-up rates and the Exogenous treatment requiring data from previous endogenous migration sessions, most sessions were run with two of the three treatments. See Appendix B for an overview of the different sessions.

group-pairs per treatment, our independent unit of observation. The experiment was programmed in z-Tree (Fischbacher, 2007).

3 Theoretical Framework, Equilibrium Benchmark, and Predictions

Assuming risk-neutral preferences and common knowledge of rationality, the contest game has multiple equilibria at the individual player level, but a unique equilibrium at the group level. In line with the literature (see e.g. Konrad, 2009) we focus on the group level equilibrium. We use the equilibrium predictions from Zaunbrecher and Riedl (2016) which are $\sum\limits_{i \in A} a_i = \frac{N_B \cdot z}{(N_A+N_B)^2}$ for contributions of group A and $\sum\limits_{j \in B} b_j = \frac{N_A \cdot z}{(N_A+N_B)^2}$ for contributions of group B where N_A and N_B are the group sizes of groups A and B. As the number of players in our game is 8 and thus $N_B = 8 - N_A$ and $z = 1,920$ this results in $\sum\limits_{i \in A} a_i = N_B \cdot 30$ and $\sum\limits_{j \in B} b_j = N_A \cdot 30$. Table 2 shows the equilibrium benchmarks for each possible group size in the experiment.

Table 2: Individual Prize, Equilibrium Contribution, and Expected Payoffs by Group Size

Group Size	Individual Prize	Equilibrium Group Contribution	Expected Group Payoff	Expected Individual Payoff
1	1,920	120	1,270	1,270
2	960	180	1,500	750
3	640	150	1,410	470
4	480	120	1,320	330
5	384	90	1,230	246
6	320	60	1,140	190
7	274	61	1,429	204
8	240	1	2,879	360

Note: Numbers are rounded to integers. For the equilibrium contributions and expected payoffs, the group size of the other group is always 8 minus group size, as the number of players in our experiment is fixed at 8. Thus a group of 1 always competes against a group of 7, and so forth.

The case in which both groups have a size of four is equivalent to the Control treatment. The sum of equilibrium group contributions over both groups is 240 and the same for group sizes 2 to 6. For a group size of 1, the contribution is a corner solution as groups without an endowment constraint would contribute 210 tokens. In this case, it is optimal to contribute the full endowment of 120, whereas the opposing group of size 7 best responds by contributing 61 tokens.[4] For a group size of 8, the other group is empty and a contribution of one guarantees winning the contest. If the group of 8 would not contribute at all, they only had a 50% chance of winning the prize as the prize could in principle still be assigned to the empty group. As the payoff structure incentivises migration towards the smaller group in all but the largest groups, it was unlikely that there would be many instances in which we observe groups of 7 or 8.[5]

In order to account for social identity in the model, we follow Zaunbrecher and Riedl (2016) and adopt the utility function of the form: $u_g(a) = \alpha \cdot \pi_g + (1-\alpha) \cdot \overline{\pi}_{A \setminus g}$, where π_g is the payoff of player g, $\overline{\pi}_{A \setminus g}$ is the average payoff of player g's other group members and α is the weight on own payoffs that depends on the strength of social identity (denoted as β for a player from group B). When applied to the contest game, this translates into the following payoff function of a player g in group A:

$$u_g(\sum_{i \in A} a_i, \sum_{j \in B} b_j) = \alpha \cdot \left(\frac{\sum\limits_{i \in A} a_i}{\sum\limits_{i \in A} a_i + \sum\limits_{j \in B} b_j} \cdot \frac{z}{N_A} - a_g \right) +$$

$$(1-\alpha) \cdot \left(\frac{1}{N_A - 1} \right) \left((N_A - 1) \cdot \frac{\sum\limits_{i \in A} a_i}{\sum\limits_{i \in A} a_i + \sum\limits_{j \in B} b_j} \cdot \frac{z}{N_A} - \sum_{i \in A \setminus g} a_i \right)$$

Zaunbrecher and Riedl (2016) show that in equilibrium, group contributions for players of Group A decrease in α, the weight put on own payoffs.[6] Figure 2 illustrates the predictions of this model for different group sizes and social preference parameters.[7] For α and β equal to 1, the predictions are exactly the same as in the previous table. However, with decreasing α and β, and thus increasing weight put on the payoffs of others in the own group, equilibrium group contributions increase for all group sizes except for the instances in which we have a corner solution. However, even in the cases where we have a corner solution, contributions on group-pair level increase. This is because the small group, whose contributions do not increase beyond their endowment with decreasing α and β, faces a larger group which can increase its contribution without the endowment becoming a binding constraint. For example, in the case where group A with

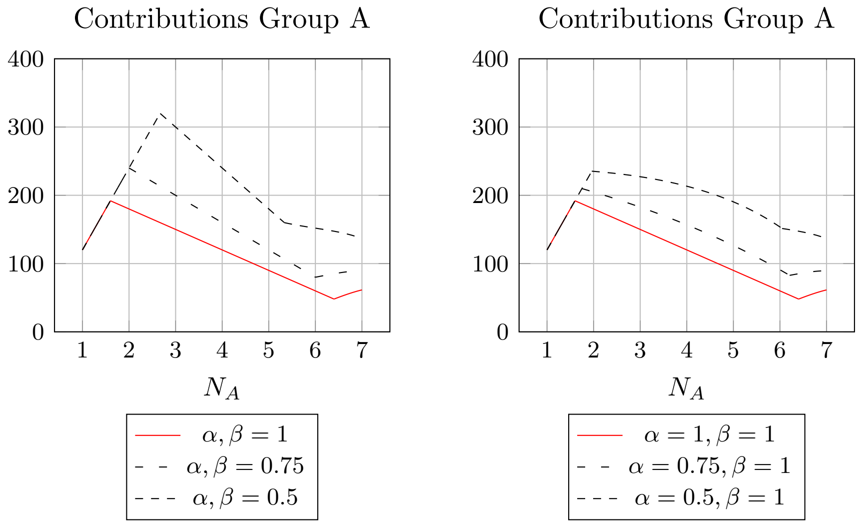
[4]While we could have increased the endowment to avoid this corner solution, we decided against this, as doing so would have made the contest prize much less important for the overall payoff.

[5]In fact, we hardly encounter any groups larger than 6 in the experiment. To address the issue of group size, we employ group size controls in our data analysis.

[6]See Appendix C for the derivation of this result.

[7]Group sizes of 0 and 8 are not shown as there is no opposing group.

$\alpha = 0.5$ and group size of 1 faces a group B with $\beta = 0.5$ and a group size of 7, group A will only contribute 120 as it is constrained by its endowment. However, group B, which would only contribute 61 if it consisted of selfish individuals, will now best respond by contributing 136.57. The only exception to this is a case in which a small group of participants with social preferences – an α or β below 1 – faces a group of purely selfish players – α or β equal to 1. This also holds if one of the social preferences parameters is decreased while the other is kept constant. Put differently, the more an individual cares about the own group, the more she contributes to the contest.[8]



(a) Symmetric social preferences **(b)** Social preferences of group B fixed

Figure 2: Equilibrium predictions by group size

Similar to Chen and Li (2009), Chen and Chen (2011), and Zaunbrecher and Riedl (2016) we associate changes in social identity with changes in α. In social psychology (Wetherell, 1996) and identity economics (Akerlof and Kranton, 2000), rigid group boundaries and exclusion are an important feature of a strong identity. Previous findings in economic experiments confirm this and find better performance in groups with stronger group cohesion (Eckel and Grossman, 2005;

[8] An alternative way to model this could include weights on the own payoff, the payoff of the own group, and the payoff of the other group. However, there are both empirical and practical reasons to focus on the own group. There is stronger evidence for ingroup concerns than for outgroup concerns (see e.g. Dogan et al. (2022)), and as the payoffs of the two groups are inversely linked through the contest success functions in our experiment, putting more weight on the other group has the same effect as decreasing the weight on the own group's payoffs and vice versa. Appendix D provides equilibrium predictions for such a model. As including an additional weight on the other group's payoff does make the model considerably less tractable and requires many additional assumptions, we chose to stick with the more parsimonious model presented here.

Chen et al., 2014) and lower cooperation if an outsider joins the group (Grund et al., 2018), or if group entry is easily possible (Ahn et al., 2011). Introducing migration in a group contest setting should thus weaken identification with the own group. In our model, this would imply that relative to fixed groups, α – the weight on the own payoff – increases while equilibrium contributions go down. Thus we hypothesise that introducing migration into the group contest decreases group contributions.

Main Hypothesis: *The average group contribution in the migration treatments is lower than in the Control treatment.*

Furthermore, we have multiple sub-hypotheses regarding the channels through which we expect a decrease in contributions. The existence of migration could lead to less identification with the own group as the 'friend' of today can be the 'enemy' of tomorrow and vice versa. Thus, players should have a weaker social identity and be less prosocial towards their own group. As a consequence of the lower identification with the own group, group contribution would thus also be lower. As this is a result of the *possibility* to migrate, lower ingroup bias, lower prosociality towards the ingroup, and lower group contributions should already be observable in the first round.

Sub-Hypothesis 1: *Ingroup bias, SVO towards ingroup, and group contributions are lower at the beginning of the migration treatments than at the beginning of the Control treatment.*

Moreover, in treatments with the possibility of migration, we expect the ingroup bias, prosociality towards the own group, and consequently the contest contribution to further decrease between the start and the end of the experiment due to group boundaries being fluid and initial social identity being eroded through group member turnover. Thus, we should see a decline in ingroup bias and SVO towards the ingroup between the beginning and end of the migration treatments and a corresponding decrease in contributions throughout the experiment.

Sub-Hypothesis 2: *Ingroup bias, SVO towards ingroup, and group contributions are higher at the beginning of the migration treatments than at the end and the change is significantly different from the Control treatment.*

The mechanism we hypothesize is independent of the actual decision to migrate, so we would expect it to affect participants in the exogenous and Endogenous Migration treatment in a similar fashion. However, there are many reasons why behaviour in the Migration treatment with endogenous migration decision could be different. Players could sort into high and low contributing groups based on their own contribution preference, migration decisions could be interpreted as a signal about the status of the groups, or players are unsatisfied with their group and migrate to be able to 'punish' them. Thus, the Exogenous Migration treatment allows us to cleanly identify the effect of migration, independent of potential confounds that more natural endogenous decisions do introduce.

4 Results

We first provide descriptive statistics and analyse the group-pair level data for which we derive the main hypothesis. In the subsequent analysis we investigate the role of ingroup bias and SVO, and drivers of the decision to migrate.

4.1 Descriptive Statistics and Non-Parametric Analysis

Figure 3 presents the average group contributions over time per treatment together with the average group contributions predicted by the risk-neutral Nash equilibrium without social preferences.[9] There is considerable overcontribution in all treatments and none of the treatments converges towards the Nash Equilibrium. Contributions start off at a similar level but diverge around period 3. The contributions in the Exogenous Migration treatment drop below the contributions in the Control treatment whereas the contributions in the Endogenous Migration treatment rise above it. If we only consider independent observations – average contributions over time and group-pair – we observe that mean group contributions are higher in the Endogenous (Mean = 221.08; Std. = 50.69; N = 10) and lower in the Exogenous Migration (Mean = 181.27; Std. = 63.86; N = 10) than in the Control treatment (Mean = 198.60; Std. = 33.15; N = 10). Comparing the contributions in the different treatments does not reveal significant differences between the treatments ($p = 0.33$, Kruskal-Wallis test). Contributions in the first round also do not differ significantly ($p = 0.875$, Kruskal-Wallis test).

Result 1: *There is no significant difference in average group contributions across the three treatments*

One possible explanation for this result could be a lack of migrations. By contrast, Figure 4 shows that this is unlikely to be the case. All groups start as groups of four but already in period three, only a minority of groups are groups of

[9] This Nash equilibrium holds for groups of size 2–6. For the other group sizes, predicted average group contributions would actually be lower because of corner solutions (see Section 3).

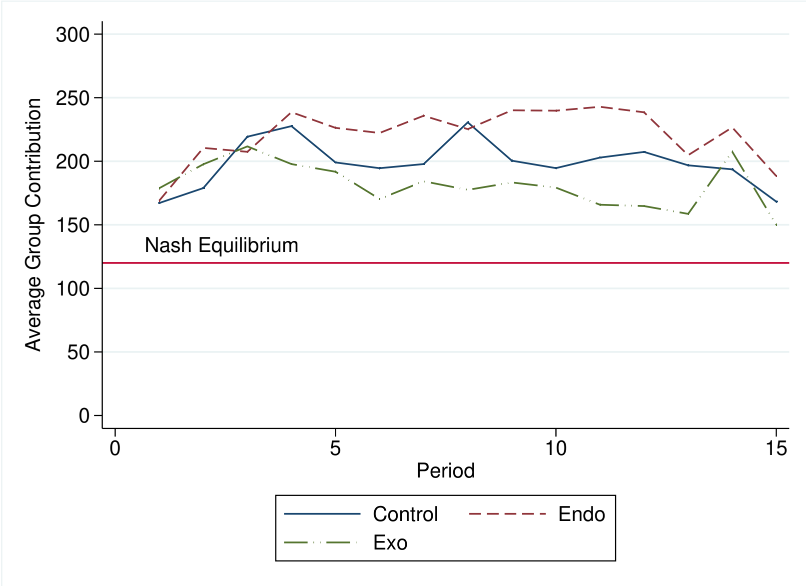


Figure 3: Development of group contributions over time and by treatment

four. Given the strong incentives to migrate to smaller groups, it is not surprising that only a few groups of size six and larger (and 2 or lower) are observed. In total, 36.9% of group-pairs in the migration treatments are groups of 4, 43.6% are groups of 5 and 3, 14.1% are groups of 6 and 2, 4.7% are groups of 1 and 7, and 0.7% are groups of 8. Even though these differences in group sizes should not affect the average equilibrium group contributions in a group-pair according to the risk-neutral theoretical benchmark, the coincidence of diverging group sizes and diverging contributions after period 3 suggests that this could still be an important factor.[10] As averaging over time and group-pair reduces the statistical power considerably, we also conduct regression analysis in which we can control for different group sizes and time-serial dependency.

4.2 Treatment Comparison – Group-pair Regression with Controls

Table 3 reports the results of random-effects regressions in which we cluster the standard errors on group-pair level (30 clusters) and use the average group contributions in a group-pair in each period as dependent variable. The Control treatment without migrations is always the reference group.

Using only the migration treatment dummies *Endo* and *Exo* as independent

[10]As described in the discussion of the theoretical predictions, with group sizes of 1-7 and 0-8, we would actually expect lower contributions. However, these only make up a very small number of observations.

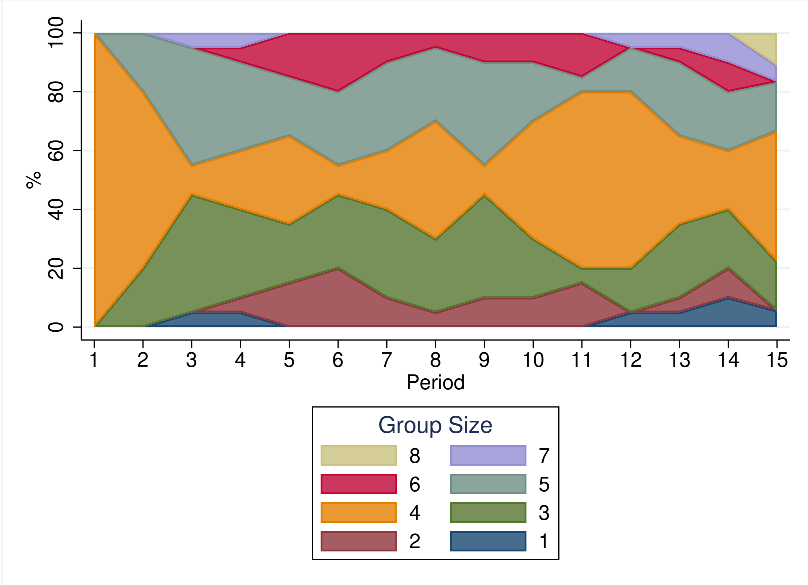


Figure 4: Development of group size over time

Table 3: Random-effects regressions of average group contributions averaged at group-pair level

	(1) *Avg.Group contribution$_t$*	(2) *Avg.Group contribution$_t$*	(3) *Avg.Group contribution$_t$*	(4) *Avg.Group contribution$_t$*	(5) *Avg.Group contribution$_t$*	(6) *Avg.Group contribution$_t$*
Endo	22.48 (18.52)	25.94 (19.81)	7.47 (5.99)	13.52* (7.36)	20.88*** (8.01)	18.46** (7.33)
Exo	−17.33 (22.00)	−13.87 (21.33)	−6.84 (6.61)	−1.07 (7.26)	−11.17* (6.65)	−12.92** (5.99)
Group-Pair Contribution$_{t-1}$			0.73*** (0.04)	0.72*** (0.05)	0.71*** (0.04)	0.72*** (0.04)
#Migrations$_t$					17.60** (7.54)	9.64 (7.95)
#Migrations$_t$ × Endo					−27.50*** (8.56)	−27.18*** (10.50)
Constant	198.6 *** (10.14)	198.6 *** (10.18)	54.78*** (8.84)	56.13*** (9.39)	59.02*** (8.78)	56.64*** (8.36)
Group size controls	No	Yes	No	Yes	Yes	No
N	450	420	450	420	420	420
Overall $R-squared$	0.056	0.121	0.538	0.604	0.615	0.549

Standard errors clustered by group pair in parentheses, * p<0.10, ** p<0.05, *** p<0.01

variables in Regression (1) does neither show significant differences between the migration treatments and the control (p-value $= 0.225$ for the Endogenous treatment and p-value $= 0.431$ for the Exogenous treatment), nor significant differences between the migration treatments.[11] Reducing the noise by including group size controls in Regression (2) and accounting for potential dynamics captured by

[11] p-value $= 0.11$, F-test with restriction $Exo = Endo$

adding lagged average group-pair contributions ($Group\text{-}Pair\ Contribution_{t-1}$) in Regression (3) separately also does not improve the significance levels of the treatment dummies. Accounting for both dynamics and group size differences in Regression (4), the difference between the Endogenous Migration treatment and the Control treatment as well as the difference between the migration treatments becomes significant at 10% level (p-value = 0.066, F-test with $Exo = Endo$ p-value = 0.059).

While this effect could be due to the migrations themselves, controlling for the number of migrations ($\#Migrations_t$, $\#Migrations_t \times Endo$) that occurred between period $t-1$ and t in the exogenous and the Endogenous Migration treatments actually increases the treatment effects and turns the negative coefficient of the Exogenous Migration treatment dummy significant at the 10% level and the positive difference of the Endogenous Migration treatment significant at 5% level (Regression (5)).[12] The number of migrations has a positive effect in the Exogenous treatment (p-value = 0.02) but a negative effect on contributions in the Endogenous Migration treatment (p-value < 0.001). This partly mitigates the respective positive and negative effects of the treatments themselves. Figure 5 illustrates this interaction effect by plotting the predicted contributions on the number of migrations for each treatment. A possible interpretation of these seemingly contradicting findings relates to the change in the reference group here. By adding the number of migrations in the migration treatments as variables, the coefficients of the treatment dummies for the Endogenous and Exogenous Migration treatment now only refer to the effects of the treatments in the case where no migrations take place. If no migrations take place in the Endogenous Migration treatment, it could be an indicator that participants were satisfied with their group contributions and have no intention to leave. As higher contributions result in higher chances of winning, this is more likely to occur when contributions are high. On the other hand, if participants decide to migrate, this might be an indicator that participants are not satisfied with the (low) contributions of their group and are thus more willing to leave. This effect is in line with our Sub-Hypothesis 2. In the Exogenous Migration treatment, by contrast, participants cannot decide to migrate but are exogenously displaced. Here, the threat of potential migration could suppress contributions, which was the hypothesised mechanism for Sub-Hypothesis 1. However, if contributions are low, the exogenous shock to the group composition caused by the displacement

[12] The average number of migrations in the migration treatments is 0.57 per round or 1 migration every 1.75 periods. Migrations have a subscript t here, because while the migration decisions are made in $t-1$, the actual migrations only take place at the start of the new period t.

could be seen as possibility to restart cooperation within the group, and thus increase contributions.[13]

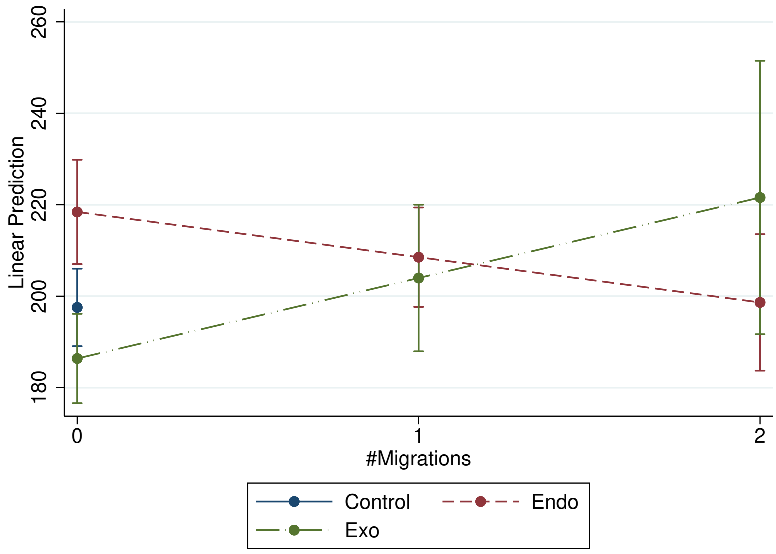


Figure 5: Marginal effect of the migration treatments at different levels of migration with 95% CI

To account for potential endogeneity issues resulting from including both the number of migrations and group size changes that are a direct result of these migrations, we also run this regression without group size dummies (Regression (6)). In this specification, the number of migrations has no significant effect on contributions anymore in the Exogenous treatment but the other results are robust.[14] Although our hypotheses are about group-level contribution, we can also run these regressions on individual contributions and control for additional factors such as beliefs, individual migration decisions, or demographics. This replicates our findings on group-pair level with the exception that the Exogenous Migration treatment dummy is not marginally significant anymore. This is probably caused by the individual migration decision and group size changes picking up some of the negative treatment effect in the Exogenous Migration treatment (see Regression (16a) in Appendix H).[15]

Result 2: *(a) When controlling for group size and lagged contributions, average*

[13]Such an effect can be observed in public good games (Andreoni, 1988; Croson, 1996; Brandts et al., 2016).

[14]In Appendix E we also run the regressions without the Control treatment, only comparing the migration treatments. Similarly to the results reported here, contribution levels are significantly higher in the Endogenous Migration treatment for the regressions with controls.

[15]An additional exploratory analysis of beliefs can be found in Appendix G.

group contributions in the Endogenous Migration treatment are significantly higher than in the Control treatment and marginally significantly lower in the Exogenous Migration treatment. (This supports Hypothesis 1 for the Exogenous treatment)
(b) Implemented migrations have a heterogeneous effect on contributions: They increase contributions in the Exogenous Migration treatment, whereas they decrease contributions in the Endogenous Migration treatment relative to groups without migrations. (This supports Sub-Hypothesis 2 for the Endogenous treatment).

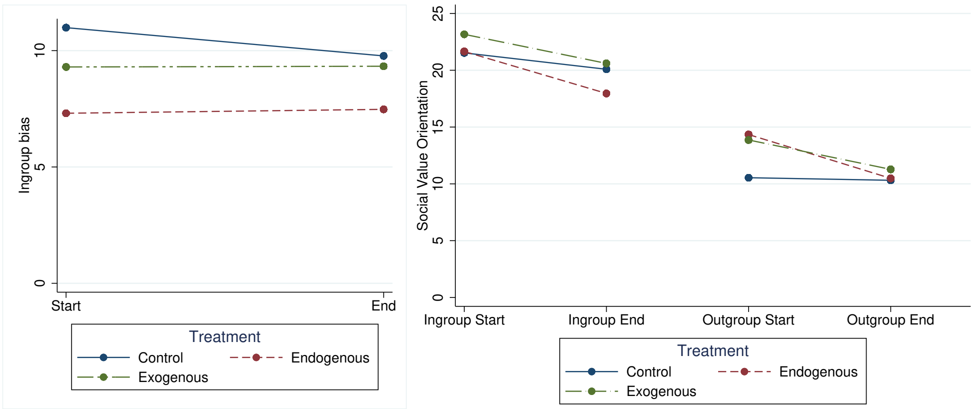
4.3 The Role of SVO and Ingroup Bias

Figure 6 shows the ingroup bias – the difference between ingroup and outgroup SVO – and the social value orientations towards ingroup and outgroup at the start and the end of the experiment. As predicted by Sub-Hypothesis 1 and shown in Figure 6a, ingroup bias is lower in the migration treatments at the start of the experiment. However, this difference is only marginally significant (p-value $= 0.097$, Kruskal-Wallis test, $N = 240$). The ingroup bias stays relatively stable and only decreases slightly for the participants in the Control treatment. There are also no significant differences in ingroup bias between the different treatments at the end of the experiment (p-value $= 0.287$, Kruskal-Wallis Test, $N = 26$)[16]. Comparing the change in ingroup bias between the treatments also does not yield significant results (p-value $= 0.987$, Kruskal-Wallis Test, $N = 26$).

Result 3: *At the start of the experiment, ingroup bias is lower in the migration treatments than in the Control treatment (supports Sub-Hypothesis 1). However, this difference is only marginally significant and the bias does not change over the course of the experiment (does not support Sub-Hypothesis 2).*

Figure 6b shows that social value orientation towards the ingroup hardly differs between treatments at the start of the experiment (p-value $= 0.847$, Kruskal-Wallis Test, $N = 240$). Social value orientation towards the outgroup is higher in the migration treatments than in the Control treatment at the start of the

[16]The difference in number of observations between the ingroup bias at the start and the end has two reasons. First, while there was no interaction between players at the start of the experiment and thus their SVO choices can be treated as independent, this is not the case anymore at the end of the experiment. Therefore, we average the ingroup bias at the end of the experiment over the players in a group-pair. Furthermore, the differences in group sizes resulted in some cases in which players did not make an ingroup decisions – because they were the only player left in the group – and other cases in which there was no outgroup left and thus no outgroup SVO decision.



(a) Ingroup Bias before and after contest, by treatment **(b)** SVOs before and after contest, by treatment

Figure 6: Development of social preferences

experiment, but this difference is not statistically significant (p-value = 0.164, Kruskal-Wallis Test, N=240). Over the course of the experiment, Social Value Orientation towards both in- and outgroup decreases in the migration treatments. For the Endogenous Migration treatment, only the drop in outgroup SVO is significant at 5% level (p-value = 0.035, Sign test, $N = 8$). For the Exogenous Migration treatment neither of the two decreases in Social Value Orientation is statistically significant (p-value = 0.144 and p-value = 0.363, Sign test, N=8). In the Control treatment, social value orientation towards the outgroup stays constant but social value orientation towards the ingroup drops between the start and end of the contest. However, this drop in Social Value Orientation towards the ingroup is not significant (p-value = 0.109, Sign test, $N = 8$). Comparing the Social Value Orientation changes across treatments does not show significant differences either (Ingroup: p-value = 0.346, Kruskal-Wallis Test, $N = 26$; Outgroup: p-value = 0.294, Kruskal-Wallis Test, $N = 26$).[17] Thus we find no support for our Sub-Hypothesis 2 that ingroup bias and Social Value Orientation towards the ingroup would decrease over the course of the experiment.

Result 4: *(a)Social value orientation towards the ingroup does not differ between treatments at the start of the experiment (does not support Sub-Hypothesis 1) and does not decrease significantly over the course of the experiment (does not support Sub-Hypothesis 2). Differences between the treatments are not significant.*

[17] An additional analysis of factors influencing changes in ingroup bias is provided in Appendix F. None of the independent variables reaches statistical significance at conventional levels.

(b) Social value orientation towards the outgroup does not differ between treatments at the start of the experiment but does decrease significantly over the course of the experiment in the Endogenous Migration treatment. Differences between the treatments are not significant.

4.4 What Drives Migration Decisions

At the end of each round, upon receiving information about contributions and the outcome of the contest, players in the Endogenous Migration treatment cast a decision to *stay* in the group or *leave* towards the other group. To gain a better understanding of the dynamics underlying this stay/leave decision, we take a closer look at various factors that potentially influence this decision. These are on the one hand variables that describe the relation between the groups, such as absolute ($Group\ contribute\ (excl.self)_t$, $Other\ group\ contribute_t$) and relative group contribution ($Own\ group\ more\ than\ other\ group_t$), own group's size ($Group\ Size\ 1{-}7_t$), changes to the group size ($Group\ increase_t$, $Group\ decrease_t$), migrations that occurred at the start of the round ($\#Migrations_t$), and winning the round (Win_t). On the other hand there are factors describing an individual player's relationship with her group, such as ingroup bias ($Ingroup\ Bias_{Start}$), own contribution ($Contribute_t$), or contributing more than the group average ($Self\ more\ than\ own\ group_t$), all of which may have a bearing on the decision to migrate.

As the stay/leave decision constitutes a binary choice, we employ a probit model for our analysis, regressing the individual decision to leave in the Endogenous Migration treatment on the set of independent variables discussed above. Table 4 presents the underlying marginal effects estimate. We find that participants' decision to migrate is mostly driven by the desire to win. To that effect, both higher relative contributions of the own group (-13.1%, p-value < 0.001), and winning the contest (-13.8%, p-value $= 0.001$) greatly reduce the probability that an individual decides to leave. Furthermore, contributions by the other group that would increase their chance of winning, attract players, as indicated by an increased decision to leave-probability (0.1% per contributed token, p-value < 0.001).

Own contribution is another factor with a significant negative effect on the decision to leave one's own group (-0.1% per contributed token, p-value $= 0.029$), which may be the reflection of the sunk cost fallacy – participants stay in their group because they have already contributed a lot on its behalf. Thus, given a hypothetical scenario in which a participant has contributed a lot, being in a group whose contributions exceed those of the other group, which also leads

Table 4: Probit: Drivers of the decision to migrate in round t

	Marginal Effects *Decision to Leave*$_t$
$Contribute_t$	−0.001*
	(0.001)
$Group\ contribute\ (excl.self)_t$	−0.001
	(0.001)
$Other\ group\ contribute_t$	0.001***
	(0.001)
$Self\ more\ than\ own\ group_t$	−0.005
	(0.065)
$Own\ group\ more\ than\ other\ group_t$	−0.131***
	(0.034)
$Group\ Size\ 1_t$	−0.036
	(0.285)
$Group\ Size\ 2_t$	0.218*
	(0.121)
$Group\ Size\ 3_t$	0.032
	(0.048)
$Group\ Size\ 5_t$	0.069
	(0.067)
$Group\ Size\ 6_t$	0.193**
	(0.078)
$Group\ Size\ 7_t$	0.285***
	(0.072)
Win_t	−0.138***
	(0.036)
$Ingroup\ Bias_{Start}$	0.001
	(0.001)
$Group\ increase_t$	−0.033
	(0.066)
$Group\ decrease_t$	−0.036
	(0.049)
$\#Migrations_t$	−0.001
	(0.041)
N	1,120

Standard errors clustered by group pair in parentheses, * p<0.10, ** p<0.05, *** p<0.01

to winning the contest round, the participant will be very unlikely to leave. Conversely, the more the other group contributes, the more likely it becomes that participants leave.

The groups size breakdown suggests that participants understand the general incentive structure and choose to leave larger groups. Being in a group of size six or seven increases the probability to leave by 19.3% and 28.5%, respectively (p-value $= 0.01$ and p-value < 0.001). Somewhat surprisingly, however, groups of two also increase participants' desire to leave by 21.8% (p-value $= 0.096$). As expected payoffs are much higher for smaller groups, our theoretical model predicted an incentive to migrate towards the smaller group (some exceptions for very large groups abound as described in Section 3). This exception for size two groups may indicate an unwillingness to contribute a high proportion of one's own endowment to the contest, as the equilibrium predictions suggest that a group of two should contribute 75% of their total endowment into the contest.

All other factors, such as, e.g., recent changes in group size, number of implemented migration decisions, or initial ingroup bias do not affect the decision to leave the group.

5 Discussion and Conclusion

In this study we present a lab experiment to identify if and how the possibility to migrate and actual migration between groups affect contributions in a group contest game. We hypothesised that migration would decrease contributions due to reduced identification with the own group as measured by social preferences. By contrast, we find that contributions increase if participants can freely choose between switching groups or staying, but only after controlling for group size differences and previous contributions. In another treatment with exogenously determined migration, contribution levels are marginally lower than in the control without migration. Social identification with the own group, as measured by the ingroup bias in the social preference tests, stays unchanged throughout the experiment in all of the treatments.

Our study adds to the literature on group contests as it is to our knowledge the first study that is not conducted with fixed groups. We find that allowing for migration between the groups does little in alleviating the rampant overcontribution that is typical for experimental contest games (Sheremeta, 2018). If anything, and in line with previous findings on endogenous groups and coalition formation in contests (Bloch, 2012; Herbst et al., 2015; Smith et al., 2012), we find that allowing free movement may aggravate the overcontribution. Interestingly, if migration does take place in the Endogenous Migration treatment, contributions decrease in the following round, suggesting that at least in the very short term, we observe the hypothesised decrease in contributions due to migration. Still, this effect is not large enough to offset overall higher contributions in the Endogenous Migration treatment and goes in the opposite direction for the Exogenous treatment, which cannot be explained by our hypotheses. One possible interpretation is, that if groups are allowed to form endogenously, migrations are an indication that participants are unhappy in their group. The analysis of the decision to migrate suggests that participants mainly leave their group to improve chances of winning and thus if migrations take place, they are likely to coincide with low contribution levels. In this case, migrations could act as a disciplining device, ensuring higher contributions by acting as a looming threat that people might leave the group if contributions are not high enough. In the Exogenous Migration treatment, participants do not get a choice to migrate but might get exogenously moved to the other group. If contributions are low, this exogenous shock to the group composition could be seen as opportunity to restart cooperation within the group. In public good games, restarting has been shown to increase cooperation at least in the short term (Brandts et al., 2016), thus a similar effect could be occurring here.

Our study also adds to the literature on group identity. We observe that groups do not need to have rigid boundaries, to maintain a social identity, demonstrated by a persistent ingroup bias in all of the treatments. Even for cases that witnessed a complete reshuffling of the group composition, we observe no discernible change to the ingroup bias. Thus, the ingroup bias triggered by relatively minimal groups already, appears to be independent from the specific composition of the group or the permanence of membership.

For a social planner who wants to minimise the wasteful rent-seeking between groups, our experiment has bad news. We find that migration does little to alleviate the waste of resources that is common in contest games and rent-seeking situations. In contrast, allowing contestants to freely migrate between groups does even seem to have an escalating effect. For countries, sports teams, or companies however, these result suggest that migration does not decrease competitiveness of the own group. Furthermore, the identification with the own team does not suffer from having turnover among group members. Thus, sports fans and company managers should not be overly concerned with "Mercenary" employees who aim to maximise their own earnings and often switch jobs or teams, as, in our setting, we find no evidence that changing composition of the own team has detrimental effects on team performance.

Our study design carries some limitations which offer avenues for future research. Our experimental design involves two groups competing for a prize, which means that when migrating, players can only move to the opposing team. Extending this to a richer setting with more groups, of which not all may be involved in the conflict, could provide interesting insights into conflict investment and self selection in a more dynamic group conflict setting. Furthermore, the groups in the experiment are small and thus every single migration constitutes a substantial change to the size and composition of the group. Using larger groups would allow to make group size and composition changes more gradual. It would also be instructive to use an extensive social identity manipulation – or to use natural groups – in the group contest to start the contest with more meaningful groups and to investigate if the effect of migration is more pronounced if the social identities of the competing groups are initially stronger.

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A Instructions

Experiment Instructions

General Instructions

Welcome and thank you for participating in this decision-making experiment. Please read these instructions carefully. If you have any questions during the experiment, please raise your hand and one of the experimenters will come to you to answer your question in private.

In this experiment you can earn money. The amount of money you earn will depend upon the decisions you make, on the decisions other participants make and on random events. Your identity will never be revealed to anyone during or after the experiment. Nor will you receive any information about other participants' identity. Your name will never be associated with any of your decisions. In order to keep your decisions private, do not reveal your choices to any other participant during or after the experiment. You will be paid in private and in cash at the end of today's session.

This experiment consists of two parts and your total earnings will be the sum of your earnings in both parts.

Throughout the experiment, your earnings will be counted in tokens. At the end of the experiment you will be paid in cash using the exchange rate

10 tokens = €0.50

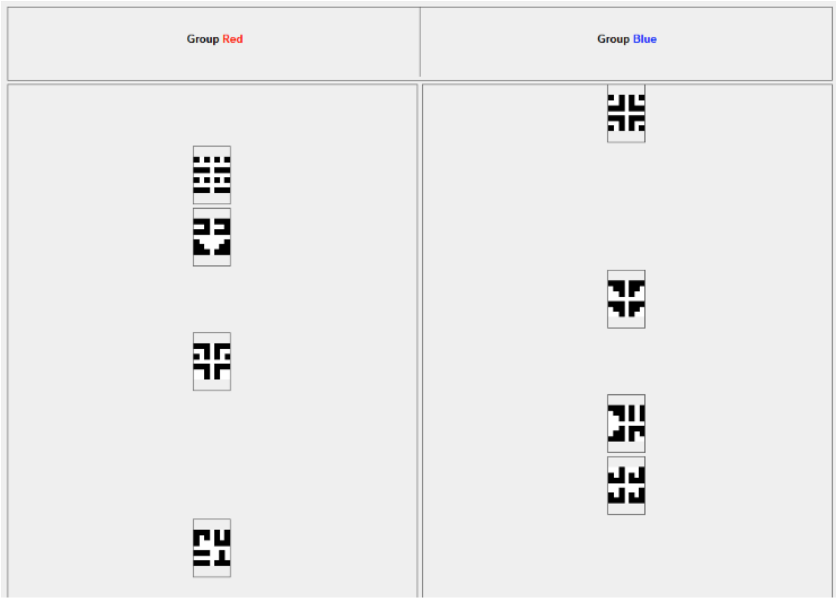
The experiment consists of a number of independent tasks, which are described in detail below. At the end of the experiment you will be asked to fill out a questionnaire.

In the experiment there are no right or wrong choices. We are solely interested in your decisions.

Groups

For the duration of the experiment you will be matched with other participants into two groups. One group will be called the RED group and the other group will be called the BLUE group. At any point in time during the experiment you will be a member of either the RED group or the BLUE group.

You and the other participants you are matched with will be identified with unique anonymous symbols. The experiment consists of several rounds. The symbols will appear in an overview screen at the beginning of each round as seen in the example screen below:



At the beginning of Part 1 of the experiment, you will get to know the group you are assigned to as well as the anonymous symbol that represents you.

Part 1

In this part you will be asked to make decisions in **2 rounds**, and **in each round** you will face **6 decision situations**. **Your choices** in these decision situations will **affect the earnings of both you and another participant**, whom we refer to as "the Other". All decisions will remain anonymous and confidential. You will not get to know the identity of the Other nor will the Other (or anybody else) get to know your identity. You will however, get information on the group membership of the Other.

- **In the first round, the Other will be a member of your <u>own group</u>.**

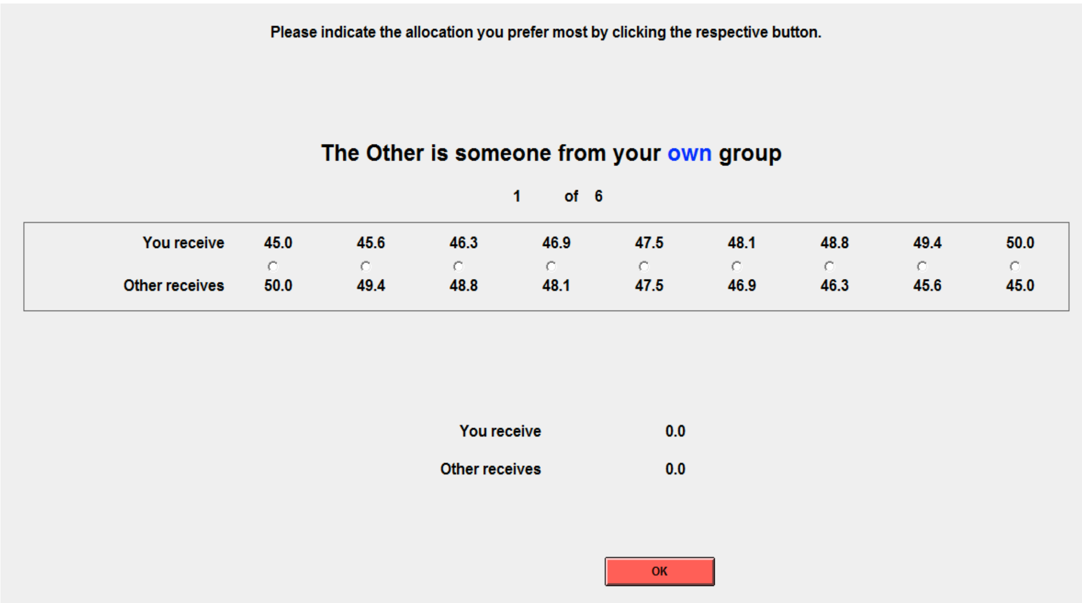
- **In the second round, the Other will be a member of the <u>other group</u>.**

The order of the 6 decision situations within each round will be determined randomly by the computer.

At the end of the experiment there will be a part similar to this one.

Decision Situations

In each decision situation you will allocate tokens between you and the Other. Each decision situation will have 9 options. Here is an arbitrary example of a decision situation:



You should choose the allocation you prefer most. Each allocation may lead to different earnings for you and/or the Other. In the example above, you would be making allocation decisions between you and another member of your own group during this round. In this example the word “own” is in blue. **In the actual decision situations, the colour of the word “own” will be the same as the colour of the group you belong to in this part.**

In the example decision situation, if you would choose the leftmost allocation, you would earn 45 tokens and the Other would earn 50 tokens. If you would choose the rightmost allocation, you would earn 50 tokens and the Other would earn 45 tokens. The earnings for you and the Other from allocations in-between are derived similarly.

You select an allocation by clicking on the corresponding button with the mouse. After an allocation is selected, the earnings for you and the other will appear at the bottom of the screen

When you are satisfied with your selected allocation you will need to confirm your choice by clicking on the "OK" button at the bottom of the screen.

Payment Part 1

After all participants have made all their decisions in the experiment, the computer will determine each participant's earnings in this part using the following procedure.

[Step 1] It is randomly determined if the decisions in this part or the decisions in a similar part taking place at the end of the experiment are paid out.

[Step 2] The computer will randomly assign half of the participants to be paid as "active" participant and the other half to be paid as "passive" participant.

[Step 3] Each active participant is paired with exactly one passive participant. Therefore, as active participant, you will be either paired with someone from your own group or someone from the other group. In the first case only decisions towards your own group will be relevant for your earnings. In the latter case only decisions towards the other group will be relevant for your earnings.

[Step 4] For each pair of active and passive participants, one of the active participant's six decisions will be randomly selected by the computer. The active participant receives the "You receive" amount of tokens and the passive participant receives the "Other receives" amount of tokens.

Important!

The used procedure guarantees that each active participant is paired with one – and only one – passive participant and vice versa.

When making your decision you will not know whether you will be an active or a passive participant in the earnings determination nor will you know the decision situation that counts for your and the Other's earnings. Therefore, **you should view each decision situation as equally important and consider each of your choices as the one that determines your and the Other's earnings.**

Your choice in one decision situation does not affect any other decision situation. Therefore, **you should consider each decision situation independent of each other**.

Nobody will be informed about your decisions. Likewise you will not receive any information of the decisions of other participants.

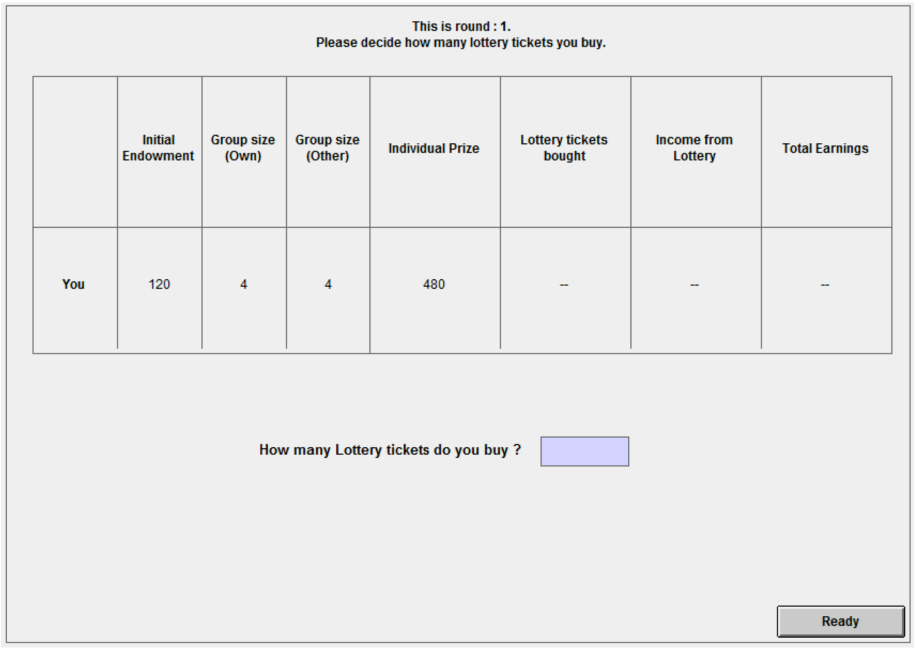
Comprehension Questions

You will now be asked to answer some comprehension questions about how your decisions affect your earnings and earnings of others. After you have correctly answered the comprehension questions, please wait for the experiment to continue.

Part 2

This part consists of 15 rounds. In each round the red and the blue group are competing for a prize in the following way: **Each group member will be endowed with 120 tokens** which are put in the member's **private account**. This will be called "Initial Endowment". Each member can use these tokens to **buy lottery tickets for the own group**. **Each token buys one lottery ticket**. **Any token not used** for buying lottery tickets **will remain in the member's private account**. Each member can buy tickets only for his or her own group. All decisions are made simultaneously and anonymously.

The lottery tickets purchasing decision screen is shown in the example below:



After you have decided how many tickets to buy, you will be asked for your **best estimate** of the **average amount of tickets** bought by the **other group members** of your **own group** and the average amount of tickets bought by the **members of the other group**.

After all members in both groups have made their decisions, **a lottery will determine whether your group or the other group wins a prize of 1920 tokens**. For this, all bought tickets are put in a "virtual" urn and one of these tickets will be randomly drawn as the winning ticket. If the ticket drawn is from a member of your own group your group will win the prize. If the ticket drawn is from a member of the other group the other group will win the prize. Each ticket in the urn has the same chance to be drawn.

In other words, if you and the other group members of your own group buy in total X tickets, and the group members of the other group buy in total Y tickets, then the chance that your group wins is given by $\frac{X}{X+Y}$ and the chance that the other group wins is $\frac{Y}{X+Y}$.

Hence, **the group which buys more tickets has a higher chance of winning the prize than the group which buys less tickets**.

Note: If your group and the other group buy the same total amount of tickets, then the chance of winning the prize is 50:50. This is also the case if none of the groups buys any tickets. If your group buys K-times as many tickets as the other group, then also your group's chance is K-times as high as that of the other group. If only one of the groups buys tickets, then this group wins the prize with certainty.

After the winning group is determined, the **prize of 1920 tokens is shared equally among the members of the winning group** and added to the private accounts. For a group of 4, this means that the individual prize for each member of the winning group is 480 tokens. The individual prize is displayed on the screen when you make your purchasing decision.

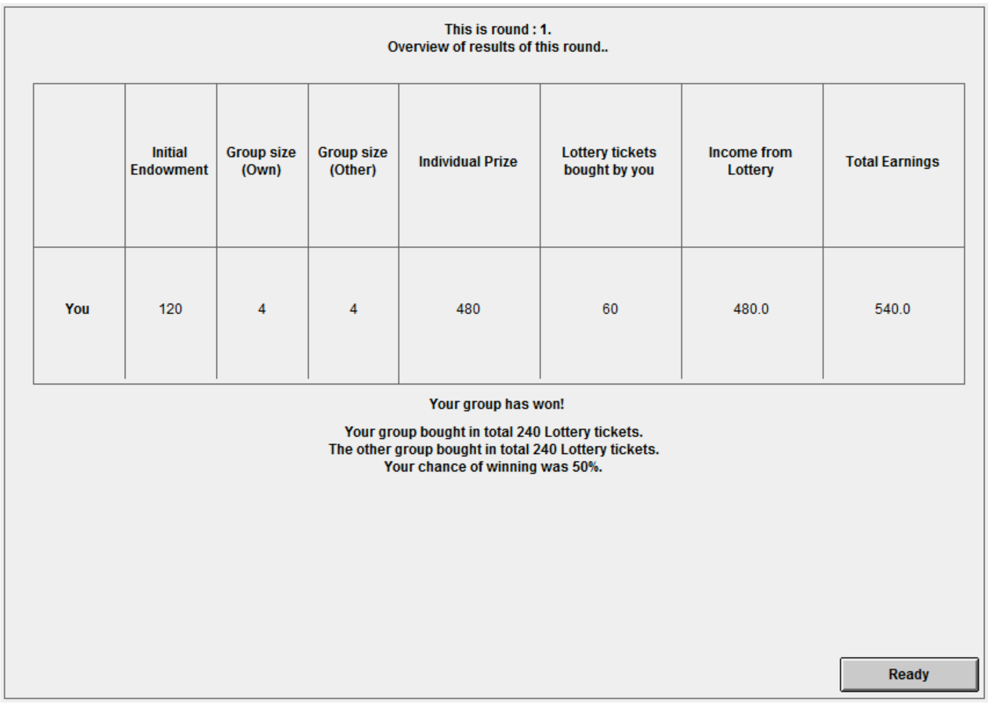
Thus, the earnings of a member of the winning and the losing group, respectively, are calculated as follows:

Earnings of a member of the winning group: 120 – bought lottery tickets + 480

Earnings of a member of the losing group: 120 – bought lottery tickets

At the end of each round you get information about your earnings, your own group's total amount of tickets bought, the other group's total amount of tickets bought, the winning chances given these total amounts of tickets bought and which group won the prize.

The next screen shows an example of a screen at the end of a round for a member of the winning group (the screen for a member of the losing group looks similar):



This is round : 1.
Overview of results of this round..

	Initial Endowment	Group size (Own)	Group size (Other)	Individual Prize	Lottery tickets bought by you	Income from Lottery	Total Earnings
You	120	4	4	480	60	480.0	540.0

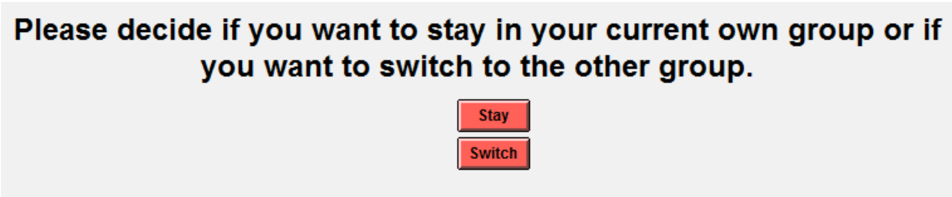
Your group has won!

Your group bought in total 240 Lottery tickets.
The other group bought in total 240 Lottery tickets.
Your chance of winning was 50%.

Ready

[Baseline: Your own group is the same as your own group in Part 1. Likewise, the other group is the same as the other group in Part 1. You and all other members of your group will remain members of your own group throughout all 15 rounds. The same holds for the members of the other group.]

[Endogenous Migration: In Round 1 of this part your own group is the same as your own group in Part 1. Likewise, in Round 1 of this part the other group is the same as the other group in Part 1. **At the end of Round 1 and each subsequent round** (except for the last Round 15), **you will have to decide if you want to stay in your current own group or want to switch to the other group as illustrated in the picture below:**



.

Each other group member of your current own group and each group member of the current other group also decides whether they want to stay in their respective current own groups or want switch to the other group.

After all 8 participants in your current own and other group have made their staying or switching decisions, the following procedure will determine which actual switches (if any) between groups will take place:

2 out of the in total 8 “stay” or “switch” decisions of all members of your and the other group are randomly selected and actually implemented. The other 6 not selected decisions will be counted as “stay” decisions. In each round, each of the 8 “stay” or “switch” decisions has equal chance to be one of the 2 actually implemented decisions.

As of Round 2, at the beginning of each round you will be informed about if you have stayed with your group or have switched to the group as well as your group membership (red or blue) in that round. Any group changes that took place will be visible in the overview screen. The symbols of the players that switched groups will have moved to their new group and an arrow will indicate the change.

Depending on the actually implemented “stay” and “switch” decisions, **the group sizes** (number of members in a group) **of the two groups can change between rounds**. The total prize the winning group receives stays the same irrespective of the size of the group. **This means that individual earnings from winning the prize will change with the size of the group.**

The table below shows what the individual share of the prize will be for each possible group size, in case this group wins the prize.

Group Size	0	1	2	3	4	5	6	7	8
Individual Prize	0	1920	960	640	480	384	320	274.3	240

Note: The group size is the number of all members; that is, if the size of your own group is 1 you would be the only member of this group.

The individual prize of a member in the losing group is 0, irrespective of the group size.

Example: In Round 1 both groups have 4 members and the group size of each group is thus 4. Therefore, each member of the winning group will earn 480 tokens. If after Round 1, for example, one person switches to the other group, one group will have 3 members and the other group will have 5 members. Each member of the group of 3 will receive 640 tokens in case this group wins, whereas each member of the group of 5 will receive 384 tokens if this group wins. Note that larger groups have more tokens in total and thus can potentially also buy more lottery tickets than smaller groups.]

[Exogenous Migration: In Round 1 of this part your own group is the same as your own group in Part 1. Likewise, in Round 1 of this part the other group is the same as the other group in Part 1. **After Round 1 in each round the group membership of up to two participants may change.** This happens independently of your or anyone else's decisions in this experiment.

As of Round 2, at the beginning of each round you will be informed about if you have stayed with your group or have switched to the other group as well as your group membership (red or blue) in that round. Any group changes that took place will be visible in the overview screen. The symbols of the players that switched groups will have moved to their new group and an arrow will indicate the change.

Depending on whether or not participants have switched groups, **the group sizes** (number of members in a group) **of the two groups can change between rounds**. The total prize the winning group receives stays the same irrespective of the size of the group. **This means that individual earnings from winning the prize will change with the size of the group**.

The table below shows what the individual share of the prize will be for each possible group size, in case this group wins the prize.

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Example: In Round 1 both groups have 4 members and the group size is thus 4. Therefore, each member of the winning group will receive 480 tokens. If after Round 1, for example, one person switches to the other group, one group will have 3 members and the other group will have 5 members. Each member of the group of 3 will receive 640 tokens in case this group wins, whereas each member of the group of 5 will receive 384 tokens if this group wins. Note that larger groups have more tokens in total and thus can potentially also buy more lottery tickets than smaller groups.]

Your symbol and the overview screen, showing which symbols belong to each group, will be shown at the beginning of each round.

Earnings in Part 2:

This part has 15 rounds. At the end of the experiment one of these rounds will be randomly selected to be paid out. Each round is equally likely to be paid out. Therefore, when making your decisions, you should view each round as the one relevant for your earnings.

You will receive information on how much you earned at the end of the experiment.

Comprehension Questions

You will now be asked to answer some comprehension questions about Part 2. Tokens earned in these comprehension questions, will not be paid out. After you have correctly answered the comprehension questions, please wait for the experiment to continue with Part 1.

B Session overview

Table B.1: Independent observations (group-pairs) per session

Session	Control	Endogenous	Exogenous
1	1	1	0
2	0	2	0
3	2	1	0
4	0	2	0
5	0	0	1
6	0	1	0
7	0	2	1
8	0	1	1
9	1	0	1
10	1	0	1
11	1	0	2
12	0	0	1
13	1	0	1
14	0	0	1
15	3	0	0

Note: As the Exogenous Migration treatment required data from previous Endogenous Migration treatments, we only started running sessions with the Exogenous treatment on the second day of experiments.

C Equilibrium Strategies and Social Identity

The following sections present theoretical predictions and equilibrium strategies. We first analyse the game without considering social preferences, before providing an extension to incorporate social identity and comparative statics.

C.1 Equilibrium Strategy without Social Preferences

To derive the Nash equilibrium for group contributions, the first order condition of the payoff functions of individual g of group A is considered.

$$\max_{a_g} \quad \pi_g(\textstyle\sum_{i\in A} a_i, \sum_{j\in B} b_j) = e + \dfrac{\sum\limits_{i\in A} i_a}{\sum\limits_{i\in A} a_i + \sum\limits_{j\in B} b_j} \cdot \dfrac{z}{N_A} - a_g$$

Taking the derivative with respect to i_g delivers the first order condition:

$$\frac{\partial \pi_g(\sum_{i\in A} a_i, \sum_{j\in B} b_j)}{\partial(a_g)} = 0 \Rightarrow \frac{\sum\limits_{j\in B} b_j}{\left(\sum\limits_{i\in A} a_i + \sum\limits_{j\in B} b_i\right)^2} \cdot \frac{z}{N_A} - 1 = 0$$

To assure that this is a maximum, the second derivative is considered:

$$\frac{\partial^2 \pi_g(\cdot)}{\partial(a_g)^2} = \frac{-2z\sum\limits_{i\in A} a_i}{N_A\left(\sum\limits_{i\in A} a_i + \sum\limits_{j\in B} b_j\right)^3} < 0 \quad \forall \sum_{i\in A} a_i, \sum_{j\in B} b_j \in \,]0, N_A \cdot 120] \tag{1}$$

N_A is strictly positive, the contributions of group A are between 0 and $N_A \cdot 120$, thus the function is concave and the extremum a maximum except for the case where both groups contribute 0.[18] It can easily be shown that $\sum\limits_{i\in A} a_i + \sum\limits_{j\in B} b_j = 0$ cannot be a maximum as it is always optimal to at least contribute the minimal positive amount possible when the other group plays 0 as this guarantees winning the prize.

The first order condition can be solved for group contributions in group A:[19]

$$\sum_{i\in A} a_i = \sqrt{\sum_{j\in B} b_j \cdot \frac{z}{N_A}} - \sum_{j\in B} b_j \tag{2}$$

Best response for an individual b_j in group B:

$$\frac{\sum\limits_{i\in A} a_i}{\left(\sum\limits_{i\in A} a_i + \sum\limits_{j\in B} b_j\right)^2} \cdot \frac{z}{N_B} - 1 = 0 \tag{3}$$

[18] Every individual has an endowment of 120 and thus the maximum group A can contribute is $N_A \cdot 120$

[19] This function actually has two solutions, but the second solution always implies a negative contribution from player g, violating the boundary conditions

Substituting equation (2) into equation (3) gives:

$$
\begin{aligned}
\frac{\sqrt{\sum\limits_{j\in B} b_j \cdot \frac{z}{N_A}} - \sum\limits_{j\in B} b_j}{\left(\sqrt{\sum\limits_{j\in B} b_j \cdot \frac{z}{N_A}} - \sum\limits_{j\in B} b_j + \sum\limits_{j\in B} b_j\right)^2} &= \frac{N_B}{z} \\
\Leftrightarrow \sqrt{\sum_{j\in B} b_j \cdot \frac{z}{N_A}} - \sum_{j\in B} b_j &= \frac{N_B}{N_A} \cdot \sum_{j\in B} b_j \\
\Leftrightarrow \sum_{j\in B} b_j \cdot \frac{z}{N_A} &= (1 + \frac{N_B}{N_A})^2 (\sum_{j\in B} b_j)^2 \\
\Leftrightarrow \sum_{j\in B} b_j &= \frac{z}{N_A \cdot (1 + \frac{N_B}{N_A})^2} \qquad (4) \\
\Leftrightarrow \sum_{j\in B} b_j &= \frac{N_A \cdot z}{(N_A + N_B)^2} \qquad (5)
\end{aligned}
$$

Substituting equation (4) into equation (2) gives:

$$
\begin{aligned}
\sum_{i\in A} a_i &= \sqrt{\frac{N_A \cdot z}{(N_A + N_B)^2} \cdot \frac{z}{N_A}} - \frac{N_A \cdot z}{(N_A + N_B)^2} \\
\Leftrightarrow \sum_{i\in A} a_i &= \frac{N_A \cdot z}{(N_A + N_B)} - \frac{N_A \cdot z}{(N_A + N_B)^2} \\
\Leftrightarrow \sum_{i\in A} a_i &= \frac{N_B \cdot z}{(N_A + N_B)^2} \qquad (6)
\end{aligned}
$$

This result is based on the fact that members of each team have identical valuations and constant marginal costs of contribution. Further symmetry assumptions are not required for this equilibrium (Abbink et al., 2010; Konrad, 2009). Note that this result does not imply a unique solution in individual contributions as there exist infinitely many equilibria in individual contributions such that they sum up to the expression on the right hand side.

As noted above, this model does not account for other-regarding preferences nor for social identity. In Appendices C.2 and D we discuss the effect of social identity on the equilibrium predictions in some detail.

C.2 Equilibrium Strategies with Social Preferences

In order to account for social identity in the model we closely follow the work of Charness and Rabin (2002), Chen and Li (2009) and Chen and Chen (2011) who use a utility function that is a weighted average of own and others' payoffs. We adopt the utility function of the form: $u_g = \alpha \cdot \pi_g + (1-\alpha) \cdot \bar{\pi}_{A\setminus g}$, where π_g is the payoff of player g, $\bar{\pi}_{A\setminus g}$ is the average payoff of player g's other group members and α is the weight on own payoffs that depends on social identity.[20]

$$u_g(\sum_{i\in A} a_i, \sum_{j\in B} b_j) = \alpha \cdot \left(e + \frac{\sum\limits_{i\in A} a_i}{\sum\limits_{i\in A} a_i + \sum\limits_{j\in B} b_j} \cdot \frac{z}{N_A} - a_g \right) +$$
$$(1-\alpha) \cdot (\frac{1}{N_A - 1}) \left((N_A - 1) \cdot \left(e + \frac{\sum\limits_{i\in A} a_i}{\sum\limits_{i\in A} a_i + \sum\limits_{j\in B} b_i} \cdot \frac{z}{N_A} \right) - \sum_{i\in A\setminus g} a_i \right)$$

Taking the derivative with respect to a_g and setting to zero provides the individual best response function: [21]

$$\frac{\partial u_g(\sum\limits_{i\in A} a_i, \sum\limits_{j\in B} b_j)}{\partial(a_g)} = 0 \Rightarrow \frac{\sum\limits_{j\in B} b_j}{\left(\sum\limits_{i\in A} a_i + \sum\limits_{j\in B} b_j\right)^2} = \frac{\alpha N_A}{z}$$
$$\Leftrightarrow \sum_{i\in A} a_i = \sqrt{\sum_{j\in B} b_j \cdot \frac{z}{\alpha N_A}} - \sum_{j\in B} b_j \tag{7}$$

The best response function for an individual of group B with β being group B's equivalent for α:

$$\frac{\sum\limits_{i\in A} a_i}{\left(\sum\limits_{i\in A} a_i + \sum\limits_{j\in B} b_j\right)^2} = \frac{\beta N_B}{z} \tag{8}$$

Assuming that α and β are identical within the respective groups, substituting

[20] Assuming symmetry within the group would reduce the formula to the individual payoff maximisation problem which was discussed in the previous subsection.

[21] Proof of concavity/maximum is omitted as it is analogous to Equation (1), with α and β assumed to be strictly positive.

Equation (7) in Equation (8) solves for:[22]

$$\sum_{j \in B} b_j = \frac{\alpha z N_A}{(\alpha N_A + \beta N_B)^2} \tag{9}$$

Substituting Equation (9) in Equation (7) gives:

$$\sum_{i \in A} a_i = \frac{\beta z N_B}{(\alpha N_A + \beta N_B)^2} \tag{10}$$

Equivalent to the model without social preferences, this does also not imply a unique solution for individual contributions. All sets of individual contributions that add up to Equations (9) or (10) constitute an equilibrium.

D Equilibrium Predictions with Social Preferences for Ingroup and Outgroup

In this simple model that includes social preferences for outgroup and ingroup, participant utility is a weighted average of their own payoff, the payoff of the own group, and the payoff of the other group. We show the utility function and equilibrium contributions for someone from group A. A denotes the contributions of group A, B denotes the contributions of group B. N_A and N_B are the group sizes of groups A and B, respectively. a is the individual contribution for a player of group A. α is the weight on the payoff of the own group, β is the weight on the payoff of the other group. γ and δ are the equivalent weights for someone from group B. For legibility, subscripts are suppressed.

$$\begin{aligned} U = \;& (1-\alpha-\beta)\left(\tfrac{1{,}920\ A}{N_A(A+B)} - a + 120\right) \\ &+\alpha\left(\tfrac{1{,}920\ (N_A-1)\ A}{N_A(A+B)} - A + a + 120\,(N_A-1)\right) \\ &+\beta\left(\tfrac{1{,}920\ B\ N_B}{N_B(A+B)} - B + 120\ N_B\right) \end{aligned}$$

First order conditions:

$$A = \frac{8\sqrt{30}\sqrt{-B\ N_A\,(\alpha+\beta-1)\,(\alpha\,(N_A-2)-\beta\,(N_A+1)+1)} - B\ N_A\,(\alpha+\beta-1)}{N_A\,(\alpha+\beta-1)}$$

$$B = \frac{8\sqrt{30}\sqrt{-A\ N_B\,(\gamma+\delta-1)\,(\gamma\,(N_B-2)-\delta\,(N_B+1)+1)} - A\ N_B\,(\gamma+\delta-1)}{N_B\,(\gamma+\delta-1)}$$

[22] Steps are identical to the model without social preferences.

Equilibrium contributions for group A:

$$A = -\frac{1,920\ f(\cdot)^2\ g(\cdot)}{\left(f(\cdot) + N_A\ (\alpha + \beta - 1)\ g(\cdot)\right)^2}$$

where

$$f(\cdot) = (8 - N_A)(\gamma + \delta - 1)(\alpha (N_A - 2) - \beta (N_A + 1) + 1)$$
$$g(\cdot) = \gamma (6 - N_A) - \delta (9 - N_A) + 1$$

Conditions required for existence of internal solution ($\wedge$ for AND conditions and $\vee$ for OR conditions):

$$\Bigg(N_A > 0$$

$$\wedge$$

$$\Bigg(\Big(3\alpha < 1 \wedge \big(\alpha \geq \beta \vee (\alpha > 0 \wedge (1 + (-2 + N_A)\alpha > (1 + N_A)\beta \wedge 2\alpha + \beta < 1)$$

$$\vee$$

$$(\alpha + \beta > 1 \wedge \beta < 1))\big)\Big)$$

$$\vee$$

$$\Big(3\alpha > 1 \wedge \big(2\alpha + \beta \leq 1 \vee (2\alpha \leq 1 \wedge \beta < 1 \wedge \alpha + \beta > 1)\big)\Big)$$

$$\vee$$

$$\Big(3\alpha == 1 \wedge (3\beta < 1 \vee \frac{2}{3} < \beta < 1)\Big)$$

$$\vee$$

$$\Big(\beta < 1 \wedge \big((\alpha \leq 0 \wedge 1 + (-2 + N_A)\alpha > (1 + N_A)\beta)$$

$$\vee$$

$$(\alpha \leq 1 \wedge 2\alpha > 1 \wedge \alpha \leq \beta) \vee (\alpha > 1 \wedge \alpha + \beta > 1$$

$$\wedge$$

$$(\alpha - \beta)(1 + (-2 + N_A)\alpha - (1 + N_A)\beta) < 0)\big)\Big)$$

$$\vee$$

$$\Big(\alpha \leq 1 \wedge 2\alpha > 1 \wedge \alpha > \beta \wedge \alpha + \beta > 1 \wedge 1 + (-2 + N_A)\alpha < (1 + N_A)\beta\Big)\Bigg)\Bigg)$$

$$\vee$$

$$\Bigg(2\alpha + \beta > 1 \wedge \bigg(\Big(2\alpha > 1 \wedge \alpha + \beta < 1$$

$$\wedge$$

$$(\alpha - \beta)(1 + (-2 + N_A)\alpha - (1 + N_A)\beta) > 0\Big)$$

$$\vee$$

$$\Big(2\alpha \leq 1 \wedge 3\alpha > 1 \wedge \alpha > \beta \wedge 1 + (-2 + N_A)\alpha > (1 + N_A)\beta\Big)\bigg)\Bigg)$$

The following two figures illustrate the comparative statics of the model for the simplest case in which we vary one social preference parameter for group A, keeping the other constant, and group B consists of selfish individuals. Furthermore, we do not impose the budget constraint, thus contributions are allowed to exceed the endowment. With increasing weight on the payoffs of the *own* group (α), group contributions increase for all groups larger than one, as depicted in Figure D.1. For increasing weight on the *other* group's payoffs (β), by contrast, group contributions decrease, as illustrated in Figure D.2. The same pattern persists when we allow both parameters to vary and also when the other group has social preferences, but corner solutions become more common.

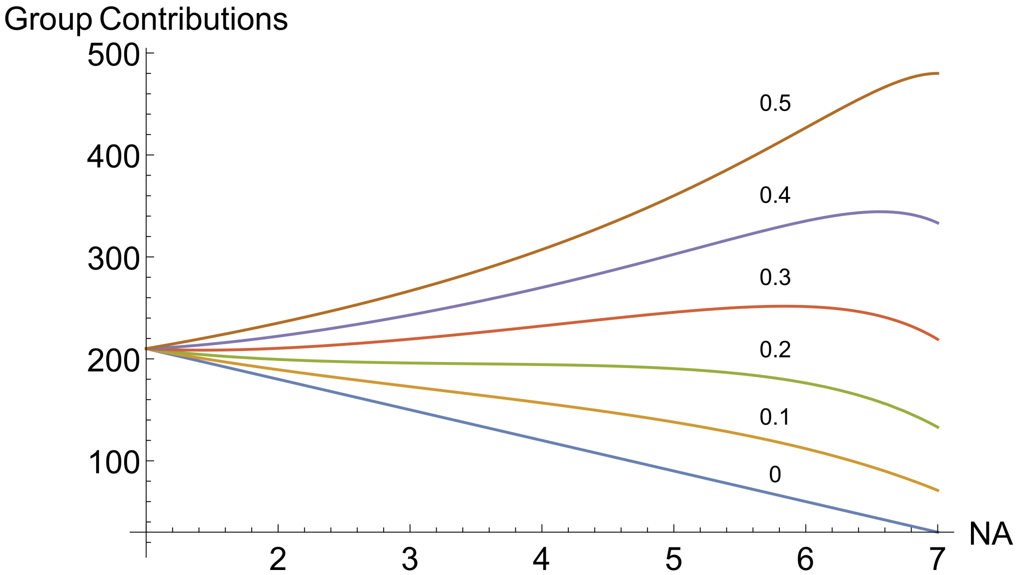

Figure D.1: Group contributions with varying α ($\beta = 0$)

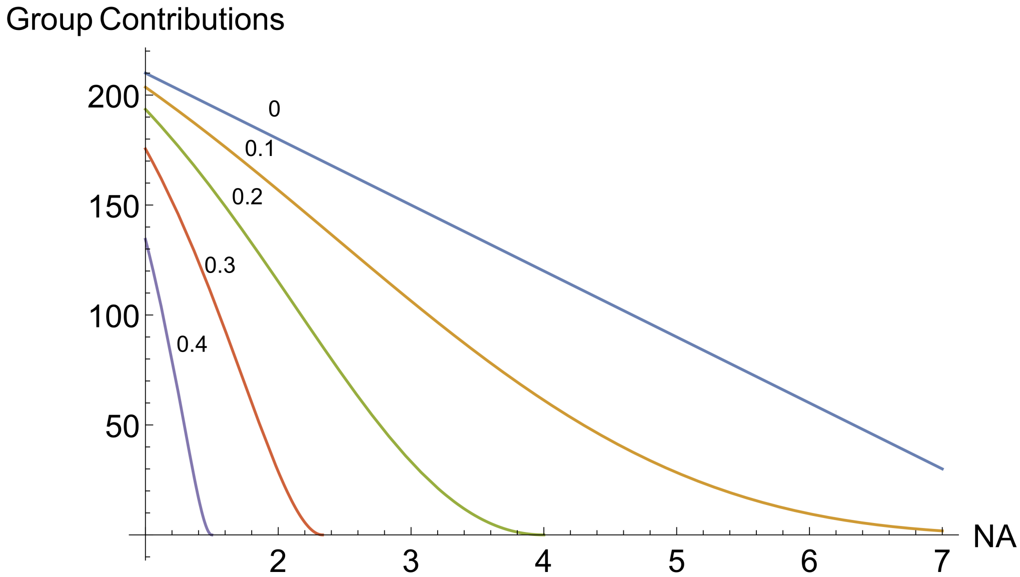

Figure D.2: Group contributions with varying β ($\alpha = 0$)

E Comparing Contribution in the Migration Treatments only

Table E.1: Comparing Exogenous and Endogenous Migration at Group-Pair Level

	(1a) Group contribution	(2a) Group contribution	(3a) Group contribution	(4a) Group contribution	(5a) Group contribution	(6a) Group contribution
Endo	39.81 (25.14)	39.81 (24.95)	13.03* (7.55)	13.35* (7.15)	30.53*** (7.02)	29.70*** (8.54)
$Avggroupcontributions_{t-1}$			0.76*** (0.05)	0.75*** (0.05)	0.73*** (0.05)	0.75*** (0.04)
$\#Migrations_t$					16.92** (7.57)	9.00 (7.93)
$\#Migrations \times Endo_t$					−26.77*** (8.64)	−26.38** (10.63)
Constant	181.3 *** (19.69)	184.6 *** (18.94)	42.04*** (10.49)	48.91*** (13.46)	42.85*** (12.81)	38.64*** (10.13)
Group size controls	No	Yes	No	Yes	Yes	No
N	300	300	280	280	280	280

Exogenous Migration treatment as baseline. Standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01

F What Explains Change in Ingroup Bias?

Table F.1: OLS regression of Change in Ingoup Bias Regressed on Various Factors and Controls

	(7a) Change in ingroup bias
Endo	7.905
	(5.214)
Exo	7.156
	(5.824)
#Migrations	−0.600
	(0.538)
#Wins	0.416
	(0.489)
#OwnMigrations	−0.722
	(1.306)
Average own contributions	−0.003
	(0.003)
Average contributions of own groups	0.010*
	(0.005)
Constant	6.264
	(16.64)
Survey Controls	Yes
N	206

Note: Standard errors clustered by group pair in parentheses. Adding additional interactions of treatment and independent variables does not improve model performance (as judged by Akaike's and Bayesian information criteria). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

G The Role of Beliefs

Average beliefs about the contributions of the own and the other group do not differ significantly between treatments (p-value = 0.545 for the beliefs about the own group, p-value = 0.237 for beliefs about the other group, Kruskal-Wallis test). However, on an individual level, we detect some interesting dynamics.

Table G.1 shows that participants seem to have a good understanding of the effect that group size has on the optimal level of contributions. They expect smaller groups – $Group\ Size\ 1-3_t$ for beliefs about the own group and $Group\ Size\ 5-7_t$ for beliefs about the other group – to contribute more and larger groups to contribute less for both the own as well as the opposing group.[23] The effect of ingroup bias ($Ingroup\ Bias_{Start}$) on beliefs about the contributions of the other group is weakly significant and positive (p-value $= 0.05$), suggesting that more ingroup-biased participants expect higher contributions from the opposing group. However, in absolute terms this effect is not very large as the mean ingroup bias across all treatments is only 9.2 resulting in an increase in beliefs about the other group's contribution by $\sim$0.8 tokens. Beliefs about own and other group contributions are also strongly positively affected by how much the participant herself ($contribute_{t-1}$), her own group ($owngroupcontribute_{t-1}$), and the other group ($othergroupcontribute_{t-1}$) contributed in the preceding period (all significant at 0.01% level). Interestingly, a decrease or increase of the group size ($Group\ decrease \times Endo_t, Group\ increase \times Endo_t$), compared to last round, does not have an additional effect for the beliefs about the contributions of the own group, but strongly decreases beliefs about the contributions of the other group in the Endogenous Migration treatment (Joint significance test p-value < 0.01). If the own group size decreases and the change is exogenously caused ($Group\ decrease_t$), participants expect the other group to contribute 10.45 tokens more. However, if the own group size decreased because someone decided to leave, this effect disappears ($Group\ decrease_t + Group\ decrease \times Endo_t = -0,79$). If the participant decided to leave the group in the previous period ($Leave\ decision_{t-1}$), but was not allowed to leave, she expects the average contributions of the own group to be lower by about 4.90 tokens and the other group's contributions to be higher by 3.63 tokens. However, if the decision to leave is in fact implemented, this effect disappears as the combined effects of migrating (4.77 for $Migration\ (Self)_{t-1}$ and 0.73 for $Migration\ (Self) \times Endo_{t-1}$) offset the negative effect of choosing to leave, which is at -4.90 (Joint significance test p-value < 0.01). Being forced to leave the own group in the Exogenous treatment ($Migration\ (Self)_{t-1}$) increases beliefs about the average contributions of the own group by 4.77 tokens. There is no effect for the number of migrations itself.

Overall, beliefs about the contributions of the own group do not vary between treatments but beliefs about the contributions of the other group are heteroge-

[23]Note that having a group size of two when stating one's beliefs about the other group, for example, means that the other group has a group size of six.

Table G.1: Determinants of beliefs about own and other group contributions in period t

	(8a) Beliefs about the contribution of the own Group	(9a) Beliefs about the contribution of the other Group
Endo	1.672	1.352
Exo	−2.790	0.289
$Ingroup\ Bias_{Start}$	0.0744	0.086*
$Group\ Size\ 1_t$		2.164
$Group\ Size\ 2_t$	12.85 *	−15.28 ***
$Group\ Size\ 3_t$	9.410***	−6.108***
$Group\ Size\ 5_t$	−5.436***	7.983***
$Group\ Size\ 6_t$	−10.24 ***	20.97 ***
$Group\ Size\ 7_t$	−13.37 ***	39.27 ***
$Group\ Size\ 8_t$	−45.57 ***	
$contribute_{t-1}$	0.111***	0.053***
$owngroupcontribute_{t-1}$	0.082***	0.032***
$othergroupcontribute_{t-1}$	0.025***	0.080***
$Group\ increase_t$	2.180	0.921
$Group\ increase \times Endo_t$	−4.094	−8.855**
$Group\ decrease_t$	0.067	10.45 **
$Group\ decrease \times Endo_t$	2.243	−11.24 **
$Leave\ decision_{t-1}$	−4.897**	3.628***
$Migration\ (Self)_{t-1}$	4.769***	−2.152
$Migration\ (Self) \times Endo_{t-1}$	0.726	−2.199
$\#Migrations_{t-1}$	−0.595	−4.577
$\#Migrations \times Endo_{t-1}$	−0.041	6.238
Constant	31.99 ***	17.27 *
N	3,346	3,328

Standard errors clustered by group pair and suppressed for legibility.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

neous as individuals react differently to group size changes depending on the treatment they are in.

H Individual Regressions – Drivers of the Contribution Decision

Using individual-level data, Table H.1 presents the estimates for the treatment effects and migration dynamics on individual contributions. This analysis replicates findings from the group-pair regressions of Subsection 4.2 in that the treatment effects of the migration treatments on their own (10a) or with group size dummies (11a) are not significant. While adding ingroup bias ($Ingroup\ Bias_{Start}$) does not change the significance (12a), controlling for differences in group size, winning the previous round (win_{t-1}), and initial contribution levels ($contribute_{t-1}$, $owngroupcontribute_{t-1}$, $othergroupcontribute_{t-1}$), similar to the group-pair regressions, renders the Endogenous treatment dummy positive and significant (13a).

Table H.1: Individual contribution decision

	(10a) contribute	(11a) contribute	(12a) contribute	(13a) contribute	(14a) contribute	(15a) contribute	(16a) contribute
Endo	4.20	6.61	7.17	4.38**	4.58**	4.44**	5.02**
	(4.79)	(4.96)	(5.09)	(2.00)	(2.33)	(2.24)	(2.34)
Exo	−5.50	−3.09	−2.83	0.37	1.30	−0.83	−0.50
	(5.17)	(5.14)	(5.06)	(1.93)	(2.01)	(1.89)	(1.90)
$Ingroup\ Bias_{Start}$			0.15	0.09**	0.03	0.02	0.01
			(0.10)	(0.04)	(0.05)	(0.05)	(0.05)
$contribute_{t-1}$				0.58***	0.44***	0.45***	0.43***
				(0.04)	(0.05)	(0.05)	(0.04)
$owngroupcontribute_{t-1}$				0.01	−0.05***	−0.06***	−0.06***
				(0.02)	(0.01)	(0.01)	(0.01)
$othergroupcontribute_{t-1}$				0.02**	0.01	0.02*	0.01
				(0.01)	(0.01)	(0.01)	(0.01)
win_{t-1}				0.65	0.15	0.27	0.19
				(0.96)	(0.74)	(0.85)	(0.87)
$Beliefgroupcontribution_t$					0.57***	0.57***	0.58***
					(0.04)	(0.04)	(0.04)
$Beliefothergroupcontribution_t$					0.01	−0.01	0.01
					(0.03)	(0.03)	(0.03)
$Group\ increase_t$						−6.20***	−6.19***
						(2.40)	(2.34)
$Group\ increase \times Endo_t$						3.90	3.77
						(4.10)	(4.02)
$Group\ decrease_t$						4.74**	4.36*
						(2.34)	(2.23)
$Group\ decrease \times Endo_t$						8.25***	8.44***
						(3.20)	(3.22)
$Leave\ decision_{t-1}$						−0.97	−0.50
						(2.04)	(1.96)
$Migration\ (Self)_{t-1}$						−3.50	−3.99
						(3.36)	(3.55)
$Migration\ (Self) \times Endo_{t-1}$						6.90	7.10
						(4.43)	(4.55)
$\#Migrations_{t-1}$						3.54*	3.86*
						(1.93)	(1.98)
$\#Migrations \times Endo_{t-1}$						−8.71***	−8.83***
						(2.77)	(2.82)
Constant	49.65***	49.65***	48.00***	14.01***	3.03	3.01	8.58
	(2.53)	(2.53)	(2.93)	(2.12)	(2.15)	(2.05)	(7.48)
Group Size Controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Survey Controls	No	No	No	No	No	No	Yes
N	3,600	3,600	3,600	3,360	3,360	3,360	3,360
$Overall\ R-squared$	0.010	0.077	0.080	0.422	0.525	0.534	0.544

Standard errors clustered by group pair in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Moreover, analysing the individual level contributions also allows us to explore the influence of group composition changes, individual migration decision, initial ingroup bias, and beliefs on the contribution decision.

The initial ingroup bias ($Ingroup\ Bias_{Start}$) does not influence consecutive contribution decisions except in a specification in which we do not account for participants' beliefs about the contribution of others, migration dynamics, and survey measures (13a). Winning in the previous period does not affect the contributions in the following round. Beliefs about the contributions of the own group ($Beliefgroupcontribution_t$) have a strong positive effect and are significant in all specifications (p-value < 0.01) whereas beliefs about the contributions of the other group ($Beliefothergroupcontribution_t$) do not seem to affect the contribution decision.[24] Overall, there are no notable differences between the specification with (16a) and without survey controls (15a).

Changes in group size carry a set of interesting dynamics for players' contribution decision. While being in a *group that increased in size* compared to the previous round ($Group\ increase_t$), contributions decrease by ∼6.19 tokens in the full specification (16a), which is partly mitigated when the group increase is caused by someone who intentionally joins the group in the Endogenous Migration treatment ($Group\ increase \times Endo_t$), reducing the effect to $-6.19+3.77 = -2.42$. Being in a group that shrunk also reflects in subsequent contribution levels, yet now towards the opposite direction. While a *decrease in group size* already leads to a ∼4.36 token increase in the Exogenous treatment ($Group\ decrease_t$), this is further amplified in the Endogenous treatment ($Group\ decrease \times Endo_t$) where the overall effect is $4.36 + 8.44 = 12.8$ (The interactions are jointly significant with $p < 0.01$). Both of these effects even compound with the factor from being in a small or large group, as we simultaneously control for the different group sizes.

This heterogeneous effect between treatments when it comes to group size changes begs the question what role a player's own migration and her migration *intentions* play in determining contribution levels. In short, neither the individual leave decision ($Leave\ decision_{t-1},\ \beta = -0.5,\ p = 0.80$), nor getting moved to the other group in the Exogenous treatment ($Migration\ (Self)_{t-1},\ \beta = -3.99,\ p = 0.26$) have a significant effect on contributions. Also the joint effect, representing an individual who wants to leave her group and gets selected to do so in the Endogenous treatment is not significantly different from zero ($Leave\ decision_{t-1} + Migration\ (Self)_{t-1} + Migration\ (Self) \times Endo_{t-1},\ \beta = 2.61,\ \chi^2 = -2.46,\ p = 0.48$).

Other players' migration behaviour, by contrast, appears to have a bearing on "the stayers". Looking at the pure effect of a migration happening, assuming that group sizes stayed constant and the individual did not decide to leave or migrate previous round, we find that migrations have a weakly significant positive effect in the Exogenous treatment ($\#Migrations_{t-1}$) and increase contributions by 3.86 tokens, but have a net negative effect in the Endogenous treatment ($\#Migrations \times Endo_{t-1}$) and decrease contributions by $3.86 - 8.83 = -4.4$ tokens. This mirrors the opposite effects migrations have between the treatments, as discussed in Section 4.2. Comparing (15a) and (16a) shows that the inclusion of the demographics variables from the post-experiment survey is inconsequential for the analysis.

[24] For a more detailed analysis on the role of beliefs, see Appendix G.

As a robustness check, we also run this regression analysis separately for each treatment to see if the independent variables affect contributions in the different treatments in a different way (Table H.2). However, besides the already discussed differences in reactions to group composition changes and migrations, we find no notable differences.

Table H.2: Pooled and Un-pooled Treatment Analysis

	(17a) Pooled	(18a) Control	(19a) Endo	(20a) Exo
Endo	5.024**			
Exo	−0.500			
Group Size 1_t	50.61 ***		62.81 ***	54.00 **
Group Size 2_t	−7.588***		−7.809	−5.662
Group Size 3_t	3.350*		2.573	3.652
Group Size 5_t	−1.038		−0.529	−1.782
Group Size 6_t	−3.369**		−4.155**	−3.928**
Group Size 7_t	−1.323		−0.313	−5.596*
Group Size 8_t	−8.371***		−2.473	−5.967
$contribute_{t-1}$	0.432***	0.507***	0.304***	0.409***
$owngroupcontribute_{t-1}$	−0.059***	−0.068**	−0.050***	−0.075***
$othergroupcontribute_{t-1}$	0.012	0.032**	0.001	−0.009
$Beliefgroupcontribution_t$	0.578***	0.447***	0.750***	0.630***
$Beliefothergroupcontribution_t$	0.001	−0.068	0.021**	0.041
win_{t-1}	0.194	0.335	−2.008	2.932*
$Ingroup\ Bias_{Start}$	0.011	0.074	0.061	−0.042
$Group\ increase_t$	−6.185***		−4.981**	−2.287
$Group\ increase \times Endo_t$	3.769			
$Group\ decrease_t$	4.361*		2.988*	12.49 ***
$Group\ decrease \times Endo_t$	8.438***			
$Leave\ decision_{t-1}$	−0.497			0.181
$Migration\ (Self)_{t-1}$	−3.991		−3.932	3.589
$Migration\ (Self) \times Endo_{t-1}$	7.102			
$\#Migrations_{t-1}$	3.863*		3.681*	−4.956**
$\#Migrations \times Endo_{t-1}$	−8.826***			
Age	−0.293	0.251	−0.510*	−0.440
Female	−2.599*	−2.777	−4.313*	−3.536
Other Europe	2.430	−0.276	1.703	6.499**
Asian	−0.178	2.767	−0.832	−2.622
Other countries	4.529*	0.964	5.577**	5.971
Econ	−3.959**	−2.540	−5.731*	−6.433
Siblings	−0.338	−1.495	−0.867	−0.163
Teamsports	−1.357	−1.884	−1.082	−1.885
Instructions	−0.083	0.995	−0.627	−0.023
Risk Seeking	1.150***	1.357**	0.701	1.208**
Teamwork	0.102	−0.348	−0.011	0.523
Constant	8.577	−6.425	21.92	17.44
N	3,360	1,120	1,120	1,120

Standard errors suppressed for legibility.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$