universität innsbruck

Faculty of
Economics and Statistics

Do groups fight more? Experimental evidence on conflict initiation

Changxia Ke, Florian Morath, Sophia Seelos

Working Papers in Economics and Statistics

2023-16

University of Innsbruck
https://www.uibk.ac.at/EconStat/

University of Innsbruck
Working Papers in Economics and Statistics

The series is jointly edited and published by

- Department of Banking and Finance
- Department of Economics
- Department of Public Finance
- Department of Statistics

Contact address of the editor:
Faculty of Economics and Statistics
University of Innsbruck
Universitaetsstrasse 15
A-6020 Innsbruck
Austria
Tel: + 43 512 507 96136
E-mail: Dean-EconStat@uibk.ac.at

The most recent version of all working papers can be downloaded at
https://www.uibk.ac.at/fakultaeten/volkswirtschaft_und_statistik/forschung/wopec/

For a list of recent papers see the backpages of this paper.

Do groups fight more? Experimental evidence on conflict initiation*

Changxia Ke† Florian Morath‡ Sophia Seelos§

October 19, 2023

Abstract

This paper investigates whether distributional conflicts become more likely when groups are involved in the fight. We present results from a laboratory experiment in which two parties can appropriate resources via a contest or, alternatively, take an outside option. Keeping monetary gains expected from fighting constant across all treatments, the experiment compares conflict choices of players in two-against-two, one-against-one, and two-against-one settings. Overall, we find evidence for a higher propensity to opt for conflict when entering the fight in a group than when having to fight as a single player. The effects are strongest in endogenously maintained groups and in the presence of group size advantages (i.e., in two-against-one). The results can be explained by a stronger non-monetary utility from fighting in (endogenous) groups and coincide with a biased perception of the fighting strength in asymmetric conflict.

Keywords: Conflict, contest, conflict resolution, group decision-making, group identity, alliance, experiment

JEL codes: C92, D70, D72, D74, D91

*We thank Tim Cason, Subhasish Chowdhury, and Heike Hennig-Schmidt as well as participants of the 8th annual conference on 'Contests: Theory and Evidence' and seminars at the University of Bath, Lancaster, and Melbourne (Experimental and Behavioural Economics seminar) for helpful comments. The ethics approval was obtained from the University Human Research Ethics Committee of the Queensland University of Technology. The experiment presented in this study was pre-registered on AsPredicted (#54539). Morath and Seelos gratefully acknowledge financial support by the German Research Foundation (DFG, grant MO 2364). Declarations of interest: none

†Queensland University of Techonology, *changxia.ke@qut.edu.au*.

‡University of Innsbruck, *florian.morath@uibk.ac.at*.

§Universitaetsstr. 15, 6020 Innsbruck, Austria. University of Innsbruck, *sophia.seelos@uibk.ac.at*.

1 Introduction

Why do socially inefficient conflicts arise even when Pareto superior options are available to the parties involved? Can behavioral aspects of group conflicts help explain this outcome, which is often considered a puzzle? Our study presents results from a laboratory experiment designed to investigate whether groups are more likely to initiate fights than individuals, and whether groups are more likely to target individuals than groups. Our findings identify specific conditions that increase the likelihood of conflict onset in group interactions, linking this decision to initiate conflict to a non-monetary utility of fighting in groups and a bias in the perceived strength of groups with size advantage. Our study sheds light on why conflicts persist despite the existence of Pareto superior options, highlights the role of group membership for conflict initiation, and provides insight into the behavioral factors that can hinder the acceptance of peaceful outside options in group conflicts, ultimately making a conflict outcome unavoidable.

Conflicts are a constant part of our social life, typically evolving around something that several want but not all can have. Such distributional rivalries may range from an argument between friends to mob violence, armed clashes, and war. In a generic model of conflict, the competing parties make irreversible investments to influence the allocation of the object they strive for. These "fighting efforts" incur costs that are sunk no matter whether a contestant wins or not, which makes conflict socially wasteful even if one disregards aspects like a loss of property and infrastructure or the massive humanitarian harm and sorrow caused by war. The resources dissipated in conflicts can be substantial and give rise to the fundamental question of why conflict emerges at all and why the contestants fail to agree on some peaceful allocation of the object at stake.[1]

In many of the real-life conflicts one could think of, the opposing contestants are typically groups, e.g., gangs, ethnic groups, communities or political parties. Accordingly, the decision to trigger conflict is taken jointly or at least influenced by several group members. Even when there is a single decision-maker deciding on onset, the fight would usually involve a large number of individuals. Thinking of small-scale conflicts such as rivalries or street

[1] Among the standard "rational choice explanations" for conflict are asymmetric information, commitment problems, resource indivisibilities, and agency problems. Wittman (1979) mentions the role of subjective probabilities of winning that may prevent a peaceful agreement. Jackson and Morelli (2011) survey theoretical explanations for war including non-rationalist explanations like ideology or revenge and point at a lack of systematic empirical studies on the origins of conflict. In the context of civil war and in light of limited conclusive evidence, Blattman and Miguel (2010) emphasize the importance of taking into account possible systematic departures from standard rational models of decision-making when explaining the emergence of conflict.

fights between members of different ethnic, religious or political groups, it is natural to ask whether the pure presence of groups plays a role when decisions to launch an attack are made. Put differently, do conflict preferences in groups differ from those of single contestants fighting alone, in an otherwise identical conflict scenario (with identical strategic incentives and expected gains or losses from conflict)?

A starting point of our analysis is the idea that the interactions in groups are accompanied by behavioral aspects that may also impact the individual preferences toward conflict. Psychological factors such as a need to belong and the urge to identify with a group can be reasons for why individuals behave differently in groups.[2] The identification with a group is often related to a more positive perception of the members of the same group and a more adverse stance toward members of other groups.[3] In line with these well-documented considerations, the mere existence of groups being involved in the conflict may change preferences toward conflict – a situation where the dividing line between the own and the other group is especially strong. Conflict initiation could become more (or less) likely, even in situations where being part of a group neither introduces a strategic advantage (e.g., a stronger fighting power) nor a disadvantage (e.g., a free-riding problem or issues of intra-group prize-sharing). Our experimental design eliminates such strategic considerations in order to be able to isolate the behavioral factors that contribute to conflict decision-making in a group setting. Given the importance of group identity for understanding the emergence of conflict, our approach provides systematic evidence on how the involvement of groups can account for the initiation of socially wasteful conflict.

In order to effectively examine the endogeneity of conflict, it is imperative that the presence of groups is exogenous, as is the case in our experimental setting. Additionally, unlike in real-world scenarios where attributing conflict initiation can be challenging, our experimental design allows for an unambiguous observation of which side triggered the conflict. This is especially relevant in cases of asymmetric conflict where it can be critical to understand whether it is the majority or the minority who is dissatisfied with the peaceful option.

Our framework outlines a two-stage game of conflict in which the emergence of conflict is endogenous. In the first stage, two contestants–groups or individuals–choose independently between initiating conflict and opting for an outside option. The outside option is a fixed

[2]The prominent social identity theory around Tajfel (1974) and Tajfel and Turner (2004) builds on the premise that individuals have a natural need to identify themselves with some people which is accompanied by separating themselves from other people.

[3]See, e.g., Sherif et al. (1961) and Tajfel and Turner (2004) for seminal research in social psychology and, e.g., Fershtman and Gneezy (2001), Charness et al. (2007), Chen and Li (2009) and Heap and Zizzo (2009) for studies in experimental economics.

payment which may represent trade possibilities or other economic benefits associated with peaceful solutions. The joint outcome of stage 1 is determined by implementing the choices made by the two contestants. If both contestants choose the same option, that choice becomes the joint outcome of stage 1. In cases where the contestants make diverging choices, a coin flip is used to determine the joint outcome. If a conflict is initiated in stage 1, the players proceed to stage 2, which is modeled as a standard Tullock contest over a predetermined monetary resource (prize). If no conflict is initiated, the game ends after stage 1 and the players obtain their outside option. Our baseline experimental setup, called *single-single*, involves two single players repeatedly playing this two-stage game, with the players being randomly re-matched with another opponent in each round of play.

In the first treatment variation, called *group-group*, both parties are two-player groups. Stage 1 decisions on conflict are made independently by each group member and are aggregated to a group decision (in a way such that each player should truthfully reveal her willingness to fight). If the contest stage (stage 2) is reached, a group must agree on a joint group effort whose cost is shared equally among the group members. In case of winning, the prize is shared equally as well. This design rules out the issues of free-riding and intra-group prize sharing as the major strategic considerations, which would change the monetary gain from fighting in groups. Accordingly, the design ensures that, as long as the prize to be gained at the individual level is kept constant, equilibrium efforts and expected payoffs are not affected by the size of the two groups and are thus identical to the *single-single* treatment. This observation forms the basis of our experimental approach and allows to focus on possible behavioral aspects of fighting in groups. The alternative theory and hypotheses below are based a non-monetary utility component of fighting, which is assumed to be larger in groups than for single contestants if (and only if) intra-group agreement on group efforts is sufficiently easy. Intuitively, fighting shoulder-to-shoulder may strengthen group identity and yield additional utility when fighting in a group, especially to those who have a "need to belong" to and identify with a group. In the spirit of Akerlof and Kranton (2000), this additional utility can be interpreted as an identity-based utility which is strengthened when group members choose to fight together.

Our second experimental treatment, called *group-choice*, endogenizes group composition by giving group members the choice of whether to maintain their group for the next round of conflict or dissolve the group and be randomly matched into a new group. This treatment manipulation, which brings the group interactions closer to real-world conflict, introduces variation in the non-monetary, identity-based utilities from fighting as a group. By allowing groups to form endogenously, it creates institutions under which group identity may be

strengthened, which could lead to higher conflict rates compared to randomly formed groups.

Our final experimental treatment, called *group-single*, focuses on asymmetric conflict. Even though standard theory would predict that the (relative) group size has no effect on equilibrium outcomes in our framework, groups with size advantage–or groups facing a single player–may perceive themselves as stronger than their opponent and expect to have a higher probability of winning the contest.[4] The treatment comparisons test whether there is a tendency for groups with size advantages to be more likely to initiate conflict and for single players facing a group to be less likely to do so. Specifically, by comparing group players in *group-single* to those in *group-group* and single players in *group-single* to those in *single-single*, we can investigate whether conflict choices depend on the size of the opponent group, keeping constant the size of (and interactions within) a player's own group.

Economic studies typically rely on all-pay contest models to analyze and understand conflict behavior. A commonly applied framework is the model by Tullock (1980), in which the amounts of the contestants' (irreversible) efforts determine victory according to a specific probabilistic ratio-form "contest success function." A growing experimental literature has tested the theoretical predictions of all-pay contests in the laboratory, typically taking the emergence of the contest as exogenous.[5] Whereas most studies consider contestants as unitary actors (single players), some work has shown that contest behavior may differ in group contests. Previous work has addressed issues like the choice of total group investment, resulting profits for different group sizes and degrees of inter-group heterogeneity (Abbink et al., 2010; Sheremeta and Zhang, 2010; Ahn et al., 2011; Brookins et al., 2015; Bhattacharya, 2016; Fallucchi et al., 2021; Huck et al., 2007), the role of free-riding, prize sharing, and intra-group conflict (Ke et al., 2013, 2015), repeated interaction (Baik et al., 2021), group identification (Chowdhury et al., 2016), and endogenous group formation (Herbst et al., 2015); see Sheremeta (2018) for a survey of experimental work on group contests.[6] In contrast to this work on contest behavior in exogenously given conflict, our focus is on choices that lead to the emergence of conflicts, making conflict onset an endogenous event.

[4]This is in the spirit of a "group size paradox" (Olson, 1965), or more precisely, of why the advantage of smaller groups may be called a paradox. For a seminal paper on the group size paradox in a conflict setup see Esteban and Ray (2001). The argument on perceived group size advantages also relates to research on overconfidence. Studies show that individuals (Moore and Healy, 2008) and groups (Healy and Pate, 2007; Hoelzl and Rustichini, 2005) are generally overconfident. There is, however, little research on overconfidence in (group) contest settings.

[5]The ubiquitous finding of higher-than-predicted efforts ("overdissipation") has been the focus of a variety of studies; see Sheremeta (2013) and Dechenaux et al. (2015) for surveys on overbidding and heterogeneous bidding behavior.

[6]For surveys on group decision-making in experimental economics more generally see Charness and Sutter (2012) and Kugler et al. (2012).

There are a few papers investigating decisions toward conflict in a setting with single players (i.e., without groups). McBride and Skaperdas (2014) consider the role of discounting of future payoffs. Kimbrough and Sheremeta (2014) and Sheremeta (2013) study side payments. Kimbrough et al. (2014) and Herbst et al. (2017) consider conflict asymmetries and mediation proposals. Kimbrough et al. (2015) focus on the degree of commitment to the outside option. Ex post choices of conflict or destruction are analyzed by Lacomba et al. (2014), Smith et al. (2014), and Miettinen et al. (2020). Similar to our study, this body of work typically assumes that conflict is inefficient. However, by accounting for the behavioral differences of group decision-making, we demonstrate that inefficient conflict is even more likely when groups are involved. In particular, our findings indicate that players who would fight in groups are generally more likely to initiate conflict than single players, but also identify conditions and institutions that yield different conflict patterns. Our results provide insights into the ways in which group dynamics influence conflict behavior and decisions on onset. Specifically, our findings suggest that group identity and the perception of strength relative to the opponent play important roles in shaping conflict outcomes. Considering the manifold examples of conflict that involves rival groups, our study contributes to a better understanding of the prevalence and complexities of conflict.

2 Theory

2.1 Framework

Consider a two-stage game between two contestants A and B. Contestant $G \in \{A, B\}$ may be a group or a single player; we denote by $n_G \geq 1$ the number of members of contestant G and assume $n_A \geq n_B$.

Stage 1 (Conflict initiation). Each contestant $G = A, B$ (a group or a single player) must decide whether (i) to initiate a contest and compete for resources of value V or (ii) take an outside option which has a value b_g for each member $g \in G$.[7] If both contestants A and B opt for the outside option, all players receive their outside option and the game ends. If both contestants opt for conflict, the game enters into stage 2. If one contestant opts for the outside option and the other opts for conflict, the game either enters into stage 2 for both contestants or ends for both with the outside option, each with equal probability.[8]

[7] As Section 3.1 describes in more detail, group members make individual decisions which are then aggregated to a group decision (ties are broken by flip of a fair coin).

[8] This procedure is advantageous from an experimental design point of view by making the contestant's optimal conflict choice independent of her beliefs about the other contestant's choice and (generically) en-

Stage 2 (Contest). Stage 2 is reached only if conflict is triggered. The conflict is modeled as a standard Tullock contest. Each of the two contestants $G \in \{A, B\}$ chooses an effort $X_G > 0$. (Groups must agree on a joint effort. Section 3.1 describes in more detail how agreement is reached in the experiment). The cost of effort is normalized to be equal to the effort itself and is split equally among all group members so that each group member's cost of effort is equal to $x_g := X_G/n_G$. Analogously, the total prize value V is split equally so that upon winning the individual prize share is $v_g := V/n_G$. (Hence, if $n_G = 1$, a single contestant pays the full cost of effort X_G and receives the full prize V.) Contestant A's probability of winning is equal to

$$p\left(X_A, X_B\right) = \frac{X_A}{X_A + X_B} \tag{1}$$

and contestant B wins with the remaining probability $1 - p$. The expected contest payoffs of member a of group A and member b of group B are thus

$$E\left[\pi_a\right] = p\frac{V}{n_A} - \frac{X_A}{n_A} = pv_a - x_a$$

and

$$E\left[\pi_b\right] = (1-p)\frac{V}{n_B} - \frac{X_B}{n_B} = (1-p)\,v_b - x_b.$$

2.2 Benchmark analysis

Due to equal sharing of effort costs and prize, the maximization of individual expected payoff $E\left[\pi_g\right]$ is strategically equivalent to the maximization of total group payoff $E\left[\pi_G\right] = n_G E\left[\pi_g\right]$: free-riding is not possible in case of cost sharing. This leads to the following benchmark result on contest behavior.[9]

Proposition 1. *Consider the contest in stage 2 and suppose that all players $g \in G$ maximize their expected payoff $E\left[\pi_g\right]$, $G = A, B$. Then, the total equilibrium efforts are*

$$X_A^* = X_B^* = \frac{V}{4} \tag{2}$$

and are independent of the group sizes n_A and n_B. The individual effort expended by player $g \in G$ is

$$x_g^* = \frac{V}{4n_G} = \frac{v_g}{4}. \tag{3}$$

suring uniqueness of the equilibrium. It also reflects a situation where a contestant cannot avoid conflict with certainty even if she opted for the outside option.

[9]Since equilibrium efforts are obtained as in a standard two-player Tullock contest, a proof is omitted.

The total expected equilibrium payoff of group $G \in \{A, B\}$ is $V/4$ and the expected equilibrium payoff of player $g \in G$ is

$$E[\pi_g] = \frac{V}{4n_G} = \frac{v_g}{4}. \tag{4}$$

This benchmark result constitutes the basis for our experimental design. First, expected group efforts in (2) are independent of the group sizes. Hence, they are the same for groups and for single players and independent of whether one competes against a group or against a single player. Moreover, as long as the individual prize $v_g = V/n_G$ is held constant, the monetary gain from conflict is independent of the size of the own group and the size of the other group. For instance, as used for the experimental setup when comparing $n_A = 2$ to $n_A = 1$, parameter configurations $(n_A = 2, V = 400)$ and $(n_A = 1, V = 200)$ result in the same individual expected contest payoff to individual a and, thus, the same incentive to opt for conflict, independent of n_B. This result is stored in Corollary 1.

Corollary 1. *Suppose that all players $g \in G$ maximize their expected payoff $E[\pi_g]$, $G = A, B$, and consider a change in the group sizes n_A and/or n_B.*

(i) *A change in the size of the opponent group does not affect the expected contest payoff $E[\pi_g]$ of players $g \in G$.*

(ii) *A change in the size of the own group $G \in \{A, B\}$ does not affect the expected contest payoff $E[\pi_g]$ of players $g \in G$ if $v_g = V/n_G$ is held constant.*

The equilibrium choices in stage 1 (conflict or outside option) are obtained by comparing the expected payoff from conflict $E[\pi_g]$ to the outside option b_g. In the experiment, b_g is chosen to be slightly higher than $E[\pi_g]$ in all treatments. Thus, in the subgame-perfect equilibrium, all players opt for the outside option and the equilibrium probability of conflict is zero.

2.3 The role of group size effects

According to the benchmark theory, there should be no group size effects (and thus no treatment effects) on conflict choices if the players maximize their monetary payoffs. The extended theory in Appendix A allows for two independent behavioral departures from the standard theory that capture a potential importance of the relative group size, that is, of the size of the own group and of the size of the opponent group. First, we allow for a non-monetary utility of fighting: individuals g do not simply expect to be able to gain $E[\pi_g]$ in the conflict but also experience a non-monetary utility δ_g from participating in the conflict. This non-monetary component δ_g may be different when fighting in a group (when $n_G > 1$)

than when fighting alone (when $n_G = 1$); in other words, we assume $\delta_g = \delta_g(n_G)$ to be a function of the own group size. The term δ_g captures a pleasure of being part of–and interacting in–a group as well as a non-monetary cost of having to reach agreement on how much effort to mobilize in the group. Another interpretation of δ_g is identity-based in line with Akerlof and Kranton (2000) where the main hypotheses below assume that fighting in groups increases the identity-based utility be strengthening group identification; in turn, group members choose to fight as this increases their identity-based utility.

Second, we incorporate the possibility of a misperception of the win probability in the contest in order to take up the idea that a group with a size advantage may overestimate its strength and thus choose conflict more often (and vice-versa for groups with size disadvantage). Such a bias may hence depend on the size of the opponent group. More precisely, for the case of asymmetric conflict, we assume that the larger group believes to win with probability $\tilde{p}_A := w(p) \geq p$ where p is the true win probability given in (1) and w is a strictly increasing and (weakly) concave weighting function. Conversely, a group with size disadvantage believes to win with probability $\tilde{p}_B := 1 - w(p) \leq 1 - p$, that is, underestimates its chances of winning for given efforts. If an increase in the size advantage shifts up the weighting function w sufficiently strongly, this yields a higher propensity to choose conflict for the larger group and a lower propensity to choose conflict for the smaller group. Appendix A contains a formal analysis of the extended theory framework, which constitutes the basis for the main hypotheses below. When presenting the hypotheses, we will further elaborate on the motivations for these behavioral departures.

3 Experimental design

3.1 Treatment conditions

Our experiment consists of four treatments. The participants in all treatments repeatedly play the two-stage game described in Section 2.1. We now explain in detail the experimental design of the baseline *single-single* treatment and the other three experimental variations.[10]

single-single ($n_A = n_B = 1$): In this baseline treatment, each participant is randomly matched with one opponent participant. In stage 1, each participant must decide if she wants to enter into a contest with the other participant (i.e., choose "continue" to stage 2) or opt for an outside option (i.e., choose "quit" the game). If both choose the outside option, the round ends and each participant receives a fixed payment of $b_g = 52$. If both choose to

[10]For a sample of the experimental instructions see Appendix C.

enter the contest, they proceed to stage 2. If the two matched participants choose different options, a coin flip determines if both enter into stage 2 or both receive the outside option. At the end of stage 1, the participants are informed about their opponent's conflict choice and the resulting next step (i.e., whether they move to the contest stage or not).

If stage 2 is reached, each player chooses a contest effort as an integer between 1 and 200.[11] The win probability of each participant is proportionate to the chosen effort level (as specified in equation (1) above) and the winner of the contest receives a prize of $V = 200$. After the efforts are submitted, a "wheel of fortune" is displayed in order to visualize the win probabilities and the process of randomly drawing the winner according to these probabilities.[12] Next to the wheel, a table displays both players' efforts, the resulting win probabilities and–once the wheel has stopped–the selected winner of the contest. At the end of the game, the participants are informed about the cost of effort to be paid, the prize received (if any), and the resulting payoff of the round.

The remaining treatments proceed like this baseline treatment except for the necessary modifications to suit the group setting. The design principle is to ensure that each individual's monetary incentive to choose "continue" to the contest stays constant across all treatments.

group-group ($n_A = n_B = 2$): In this treatment, all participants are randomly assigned to groups of two and each group is randomly matched to one opponent group. The intra-group conflict choice is derived as follows. Each participant must state if she prefers conflict or the outside option, independently and simultaneously. If both members of a group choose the same option, this automatically becomes their group decision. If one group member chooses "continue" and the other one chooses "quit", a fair coin flip determines their group decision. At the inter-group level, the conflict decision is taken as in the *single-single* treatment. At the end of stage 1, the participants are informed about the conflict choice of their group partner, the aggregate decisions in their group and in the opponent group, and whether they move to the contest stage. The total prize to be allocated is $V = 400$, to be shared equally by the two members in the winning group. The outside option is again set to $b_g = 52$ per player. The total prize is doubled such that the share of the prize each individual player receives remains the same as in the baseline treatment *single-single*.

[11] We restrict effort choices to integer values and do not allow zero effort for simplicity. This avoids having to explain what happens if both groups choose zero effort. Also, effort choices of zero may be excluded by the argument that players had the option to decide against conflict already.

[12] The fortune wheel is divided into two colors. The fractions of the colors on the fortune wheel correspond exactly to the proportion of each contestant's effort to the total efforts. The wheel starts turning and stops randomly. The color (and the corresponding participant) in which the arrow points wins the contest.

If the contest stage is reached, each group must determine a contest effort for the group (an integer between 1 and 400) whose cost is shared equally by the two group members. To reach an agreement, the group members can communicate via a chat box for up to one minute. Each member must independently choose and submit a group effort within or after the one minute of chatting. If the two group members submit different amounts, they have the opportunity to chat for another 20 seconds and to independently submit another group effort during or after these 20 seconds. If they still could not agree, their group effort is automatically set to 1.[13] Once the group efforts are determined, the game proceeds exactly as in the *single-single* treatment, with a fortune wheel for the contest outcome and the corresponding summary tables.

group-choice ($n_A = n_B = 2$, choice): A third treatment differs from the *group-group* treatment only in one respect: If a group reaches the contest stage, the group members can choose to stay with their partner ("stay together") in the next round or to be randomly re-matched with a new partner. The group members make this decision after they chatted and submitted a joint group effort but before they know the outcome of the contest. If both group members choose to stay together, they remain in the same group in the next round. If (at least) one group member decides to switch the partner, the group is dissolved and its members are randomly re-matched with new partners in the next round.

The first three treatments are all in symmetric settings ($n_A = n_B$) with identical monetary incentives for choosing "continue" vs. "quit" at the individual level in the benchmark equilibrium. Comparing the *single-single* treatment and the *group-group* treatment, systematic differences in perceived strength should be absent so that the treatment comparison focuses on non-monetary aspects of fighting in a group as compared to fighting as single players. The *group-choice* treatment makes group composition partially endogenous and should thus strengthen the non-monetary aspects of fighting in groups. This allows for comparisons of conflict decisions between the newly formed groups to groups that chose to stay together based on their joint group experience. In the remaining treatment, we introduce an asymmetric setting to study the impact of perceived relative strength on conflict choices.

group-single ($n_A = 2$, $n_B = 1$): In this forth treatment, the participants are randomly assigned to be either single or group players at the beginning of the experiment and keep this role throughout the entire experiment. The computer then randomly assigns group players to pairs and matches each group with two single players, such that in total there

[13] This is similar to the group chats in Sheremeta and Zhang (2010). We offer the opportunity to chat and agree in order to give groups some meaning and introduce variation in the (non-monetary) utility/cost of reaching agreement (see below).

are four players randomly matched together (two group players and two single players). Decision-making in the group is exactly as in the *group-group* treatment. After all players have chosen between "continue" and "quit", a fair coin flip decides which of the two single players becomes "active" for that round. The other single player does not participate in the game and receives a round payoff of zero. The active single player either receives the outside option or plays the stage 2 contest against the matched group, depending on their respective conflict choices. The outside option for each group player is still 52 and the outside option for the active single player is 104; hence, in expectation, each single player also receives an outside option of 52. The prize in the contest is $V = 400$ and must be shared by the group players.[14] The *group-single* treatment makes it possible to compare symmetric contests (*single-single*, *group-group*) to an asymmetric one: how does a change in the group size of the opponent affect conflict initiation? This should tackle the question if a group size (dis-)advantage and possibly a resulting difference in the perceived strength in the contest affects the contestants' propensity to trigger conflict.

Procedures The experiment was programmed using oTree (Chen et al., 2016) and took place at Wuhan University (China) with 368 graduate and undergraduate students participating in 20 sessions between December 2020 and March 2021. In each session we formed subgroups of participants who could be matched during the experiment.[15] All participants played one version of the two-stage game described above (i.e., one treatment) for 24 rounds. In each round, the participants were randomly re-matched, except for the *group-choice* treatment in case a group chose to stay together. In four out of the 24 rounds (rounds 1, 8, 15, 23), the participants were additionally asked to estimate their win probability in the contest. These beliefs were elicited after the participants had decided between "continue" and "quit" but before they knew if they would enter the contest stage or receive the outside option. To ensure that all participants understood the rules of the game, they had to answer several control questions before the start of the main experiment and played one trial round of the Tullock contest of their treatment variant (i.e., only stage 2) against themselves. After the 24 rounds of the main experiment, the participants were asked to fill out a questionnaire (information on gender, age, field of study, previous experience in contest experiments, comprehension) together with self-assessments of individual characteristics and preferences. At

[14]Since group players share the contest prize, their expected contest payoff $E[\pi_g]$ is only half of the expected payoff of the active single player. This is reflected in the choice of the value for the outside option. Importantly, however, *ex ante* when conflict choices are made, the expected payoff of a single player (active or not) is the same as that of a group player. Matching the group with two single players therefore allows us to keep equality of the expected payoffs of all players, within and across treatments.

[15]The size of these subgroups varied between 8 and 24 participants, depending on the treatment. For an overview of the number of sessions, participants, and subgroups see Table B1.

Table 1: Parameter values and equilibrium outcomes in the benchmark predictions

Treatment		Contest prize per player	Equilibrium effort per player	Contest payoff per player	Outside option per player
single-single	single player	200	50	50	52
group-group	group player	200	50	50	52
group-choice	group player	200	50	50	52
group-single	group player	200	50	50	52
	single player*	200 (=0.5×400)	50 (=0.5×100)	50 (=0.5×100)	52 (=0.5×104)

*An active single player in *group-single* receives a prize of 400 Tokens if she wins the contest and receives 104 Tokens as outside option if there is no contest. Ex ante, each single player has a 50 % chance to become an active player; hence, the expected (average) contest prize, equilibrium effort, expected contest payoff, and outside option are 200, 50, 50 and 52 respectively.

the end of a session, two of the 24 rounds were randomly selected; the earnings in those two rounds determined the individual payment from the experiment. Participants earned on average 10 USD and the experiment took around one hour.[16]

3.2 Main hypotheses

Table 1 summarizes prize values and outside options together with the theory prediction for the contest outcome. According to standard theory, the equilibrium effort and expected contest payoff are not affected by the treatment variations. The outside option b_g is chosen to be slightly higher than the contest payoff $E[\pi_g]$ a player can expect. Thus, strictly speaking, the probability of conflict should be zero in all treatments if the players maximize their monetary payoffs. More generally:

Hypothesis 0. *The individual probability to choose conflict is the same across all treatments.*

The benchmark Hypothesis 0 is obtained directly from Corollary 1. However, non-monetary aspects of fighting in groups could cause Hypothesis 0 to be rejected. We provide three alternative hypotheses that relate conflict choices in groups to potential differences in a non-monetary utility of fighting in symmetric settings (Hypotheses 1 and 2) and the perceived strength when fighting in asymmetric conflict (Hypothesis 3).

[16]The exchange rate from experimental currency to RMB (local currency) was 1:5. The average final payout is 68 RMB, made up of the earnings from the main experiment (around 43 RMB), a show-up fee of 20 RMB and a reward of 5 RMB for estimating the win probability and completing the post-experimental survey. The hourly rate of a student research assistant was around 50 RMB in Wuhan at that time.

Hypothesis 1. *If (and only if) the perceived intra-group agreement costs are sufficiently low, the individual probability to choose conflict is higher in the group-group treatment than in the single-single treatment:*

$$\Pr\left(conflict_g \mid n_A = n_B = 2\right) > \Pr\left(conflict_g \mid n_A = n_B = 1\right)$$

This first alternative hypothesis captures a possible difference in the non-monetary component δ_g of fighting and follows from Corollary 2 in Appendix A for the case where $\partial\delta_g/\partial n_G > 0$. In line with previous experimental results, we assume that individuals generally care about non-monetary aspects of participating in contests.[17] Findings from psychology such as in Baumeister and Leary (1995) show that humans have a natural need to belong to groups. More precisely, individuals retrieve utility from identifying with and experiencing positive interactions as a group. Especially those individuals who experience a high need to belong may enjoy interacting (fighting) in groups more than as single players. Hypothesis 1 is obtained in case fighting in groups yields a higher identity-based utility than fighting alone, implying $\delta_g(n_G = 2) > \delta_g(n_G = 1)$. The anticipation of this higher utility when fighting as a group results in a stronger preference for conflict in *group-group* than in *single-single*. There can, however, be a countervailing effect of an increase in n_G: (larger) groups may make it more difficult to reach agreement on a joint effort. A (non-monetary) agreement cost would negatively affect the decision to fight. Hypothesis 1 is formulated for the case where the positive effect on the non-monetary utility of fighting in groups dominates the cost of having to reach agreement, i.e., $\partial\delta_g/\partial n_G > 0$.[18]

As additional evidence on the role of a non-monetary utility of fighting, we draw on the *group-choice* treatment where group composition is endogenous. We expect a decision to maintain the group to have a positive effect on the identity-based utility from fighting shoulder-to-shoulder.

Hypothesis 2. *The individual probability to choose conflict is: (a) generally higher in the group-choice treatment than in the group-group treatment; and (b) higher in endogenously formed groups with the same/existing partners than in groups with random/new partners.*

The additional, non-monetary utility δ_g derived from fighting as a group may be higher in

[17] These aspects may also include other behavioral motivations that exist equally for group players and for single players (i.e., are independent of n_G). Hypothesis 1 focuses on factors that may depend on n_G.

[18] More specifically, we expect the treatment effect of *group-group* to be stronger for groups with low cost of agreement, but possibly negative for groups with high cost of agreement. Our regression analysis explores possible control variables for the "cost of agreement" using the chat time spent on discussing the joint contest effort.

existing, endogenously formed groups due to stronger group identity as well as preceding positive group interactions. Endogenously maintained groups may have been successful in mobilizing joint effort and may expect low costs of agreement; this could increase δ_g as well as lead to self-selection. For both reasons, the propensity to choose conflict is expected to be higher in *group-choice* than in *group-group* if and only if the group is kept together by choice of the group members.

The third alternative hypothesis considers asymmetric conflict in which a two-player group faces a single player. According to standard theory, the incentive for choosing conflict should neither change for the group nor for the single player, compared to the *group-group* or *single-single* treatment. However, the relative group size may matter for how strong the contestants perceive themselves in a conflict, adding the possibility of a systematic misperception of the win probability by the contestants with size advantage and disadvantage, respectively.

Hypothesis 3. *Among the treatments single-single, group-group, and group-single, the individual probability to choose conflict is highest for group players in the group-single treatment and lowest for single players in the group-single treatment:*

$$\begin{aligned} \Pr\left(conflict_a \mid n_A = 2, n_B = 1\right) &> \Pr\left(conflict_g \mid n_A = n_B = 2\right) \\ \Pr\left(conflict_b \mid n_A = 2, n_B = 1\right) &< \Pr\left(conflict_g \mid n_A = n_B = 1\right) \end{aligned}$$

This prediction builds on Corollary 3 in Appendix A. Based on psychology-related research and supported by experimental findings, individuals in groups are found to show increased self-esteem and confidence (Leary, 1999) and tend to overestimate the relative performance (rank) of their group (Brookins et al., 2014; Plous, 1995). We believe that the perception of strength depends on relative group size in a conflict. Group players facing a single player may perceive themselves as stronger and overestimate their win probability. Single players facing a group may perceive themselves as weaker and underestimate their win probability. Thus, conflict decisions made in anticipation of the corresponding *subjectively* expected contest payoff would yield a higher propensity of conflict for contestants with size advantage (namely, groups facing single players).

Focusing on the role of perceived strength, Hypothesis 3 compares two scenarios that keep the size of the own group constant. This controls for a possible dependence of the non-monetary utility δ_g on the own group size n_G, assuming, at the same time, that δ_g does not depend on the size of the opponent group. The latter, however, may not be guaranteed. For instance, the positive aspects of being part of a group may become more salient when

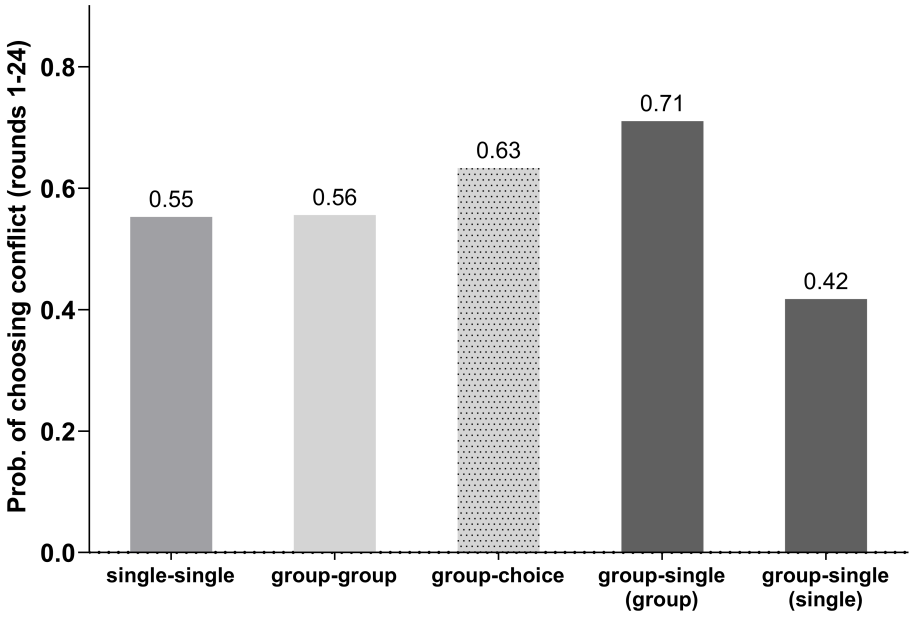

Figure 1: Individual probability to choose conflict across treatments

facing an individual who does not belong to a group. Similarly, being alone (not part of group) may be more salient when facing a group. We discuss this possibility after presenting the main experimental results. Moreover, while our main analysis focuses on treatment differences in the individual propensity to trigger conflict, the empirical analysis below also briefly comments on possible treatment differences in efforts.

4 Main results

One of the main research questions we aim to answer is whether, despite identical expected monetary gains from triggering conflict, the individual conflict choices differ across treatments: as a single player or as a group; in endogenously maintained or randomly formed groups; and against a single player or against a group. Figure 1 summarizes the decisions in favor of conflict across the 24 rounds and provides some first insights into the results. The *single-single* and *group-group* treatment exhibit a very similar proportion of conflict choices (55% versus 56%). Among the three symmetric treatments, the group players in *group-choice* choose conflict most frequently (63%) on average (unconditional on the group formation). The asymmetric treatment *group-single* shows a sharp contrast: while the group players in *group-single* (labeled as *group-single(group)*) have the highest proportion of conflict choices (71%) among all, conflict is chosen with the lowest probability (42%) by single players in *group-single* (labeled as *group-single(single)*).

Table 2 presents results of a regression analysis of the individual conflict choices using mixed-effects logistic models. The dependent variable is equal to 1 if a player opted for conflict ("continue") and is 0 if she opted for the outside option ("quit"). Overall treatment effects are included via dummy variables with "single-single" as the baseline category. Within the *group-single* treatment, we differentiate between group players ("group-single(group)") and single players ("group-single(single)"). We focus on data from rounds 13 to 24 in the regression models reported in Table 2 for two reasons: (i) As stage 1 conflict choices should depend on the players' expectations of what can be gained in the stage 2 contest, we include control variables generated from the contest data in early rounds in order to explore how contest experience in those early rounds may affect choices to trigger conflict (in later rounds). Hence, the data on conflict choices from these early rounds should be dropped. (ii) In the main text, we analyze the more stable behavior after some learning in the earlier rounds. Our main results are robust to various model specifications such as extending the analysis to all rounds or using different sets of control variables.[19]

The first estimation in Table 2 simply replicates the results shown in Figure 1 by including only the treatment dummies. It confirms that we can reject the standard theory prediction that the conflict choices should be the same across all treatments (Hypothesis 0).

Result 0. *The individual probability to choose conflict varies significantly across treatments.*

The estimation results are largely consistent with our alternative hypotheses. We first turn to the results on symmetric conflict (Hypotheses 1 and 2), followed by the results on asymmetric conflict (Hypothesis 3).

Symmetric conflict and non-monetary aspects of fighting in groups. Compared with the baseline *single-single* treatment, the individual probability of choosing conflict is weakly lower in the *group-group* treatment: the estimated coefficient in estimation (1) of Table 2 is -1.571 (p-value $= 0.053$). This effect is opposite to the prediction in Hypothesis 1; using the notation from the theory, it corresponds to $\partial\delta_g/\partial n_G < 0$, that is, a lower non-monetary utility component in groups. This either suggests the absence of a strong identity-based utility from fighting in–randomly formed–groups or this utility to be dominated by a cost of reaching agreement in groups. We first investigate the latter in more detail in estimation (2) of Table 2; afterwards we provide evidence on an identity-based utility of

[19]Figure B1 in Appendix B depicts time series data of the average proportion of conflict choices by treatment and suggests that there is some learning in the earlier rounds. All treatments show a clear decreasing trend in the first half of the experiment and a more stable conflict rate in the second half of the experiment. Table B2 reports regression results based on the full sample from rounds 1 to 24.

Table 2: Individual decision to opt for conflict

	(1) conflict$_{it}$	(2) conflict$_{it}$	(3) conflict$_{it}$	(4) conflict$_{it}$	(5) conflict$_{it}$
group-group	-1.571*				
	(0.812)				
group-choice	0.421	0.413	-0.167	-0.212	-0.383
	(0.636)	(0.629)	(0.674)	(0.556)	(0.516)
group-single(group)	1.988***	1.939***	1.915***	1.760***	1.302**
	(0.762)	(0.709)	(0.694)	(0.613)	(0.539)
group-single(single)	-3.681***	-3.570***	-3.515***	-3.253***	-2.768***
	(1.163)	(1.053)	(1.021)	(0.792)	(0.745)
group-group(high-chat-time)		-3.763***	-3.705***	-3.220***	-2.339***
		(1.004)	(0.979)	(0.743)	(0.604)
group-group(low-chat-time)		0.782	0.773	0.478	-0.066
		(0.759)	(0.753)	(0.734)	(0.618)
group-choice×same-partner			1.478***	1.476***	1.347***
			(0.446)	(0.460)	(0.478)
joy-of-fighting				0.578***	0.249**
				(0.160)	(0.098)
joy-of-fighting×group-player				-0.002	0.088
				(0.112)	(0.093)
need-to-belong				0.158	0.144
				(0.097)	(0.103)
need-to-belong×group-player				0.294**	0.199
				(0.143)	(0.136)
win-probability(estimated)					0.046***
					(0.008)
contest-payoff(rounds1-12)					0.011***
					(0.004)
Questionnaire controls	No	No	No	No	Yes
Constant	0.676	0.654	0.643	0.597	-1.893***
	(0.487)	(0.480)	(0.478)	(0.432)	(0.537)
Observations	4416	4416	4416	4416	4404

Mixed effects logistic regressions. Random intercepts at the subject level. Standard errors in parentheses, clustered at the level of matching groups. Data from rounds 13 to 24. The dependent variable "conflict$_{it}$" is equal to 1 if individual i opted for conflict in round t, and is zero if i opted for the outside option. The variable "joy-of-fighting" is based on the questionnaire statement "I see myself as someone who enjoys competing, regardless of whether I win or lose." (scale 0-10). "need-to-belong" is based on the questionnaire statement "If other people don't seem to accept me, I don't let it bother me." (scale 0-10, reversed). "win-probability(estimated)" is i's estimate of her win probability in the contest. "contest-payoff(rounds1-12)" is i's average realized contest payoff in rounds 1-12. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

fighting, using the *group-choice* treatment as well as a measure from the post-experimental questionnaire (estimations (3) and (4)).

In our context (and in general), agreement costs may have different dimensions. We focus on the time and effort spent on discussing the joint group effort with the group partner, which indicates opportunity costs as well as the level of difficulty of deciding and agreeing on an effort level and possibly compromising with the group partner.[20] The groups that spent more time in the chat are likely to be the ones that found it hard to agree with each other on a joint effort. When the group members make their conflict choice in stage 1, they have to anticipate the stage 2 group effort choice and how difficult it would be to find an agreement. We therefore use the chat experience (chat time) in early rounds as a proxy for a player's expectation of the agreement cost in the current round: those who expect a high agreement cost should be less likely to opt for conflict.[21] Based on this conjecture, we separate the group players in the *group-group* treatment by how their average total chat time experienced in the contest stage in rounds 1 to 12 (if reached) compares to the median of this value among all players in this treatment. Those who experienced lower-than-median average chat time are classified as the "group-group(low-chat-time)" category; the remaining players in this treatment are in the "group-group(high-chat-time)" category.

As shown in estimation (2) in Table 2, players in *group-group* who experienced high agreement costs are significantly less likely to choose conflict, compared to the players in the baseline *single-single* treatment (the estimated coefficient is -3.763, p-value < 0.001). In contrast, those players who experienced low agreement costs are slightly more likely to choose conflict compared to the players in *single-single*, but the difference is not statistically significant (coefficient is 0.782, p-value $= 0.303$). There is no doubt that this type of classification is arbitrary; nonetheless, it suggests that the cost of reaching agreement plays a non-negligible role in determining the relative tendency to choose conflict in the *group-group* compared to the *single-single* treatment. This finding is confirmed when using alternative proxies for measuring agreement costs such as a continuous variable or data from the very first few chats (experiences) only (see Table B4 in Appendix B). The estimations in Table B4 also show that in the (hypothetical) absence of agreement costs, that is, for groups that basically agree immediately, the probability of choosing conflict is significantly higher than in *single-single*

[20] One may also think that the time spent discussing is a proxy for how far the agreed effort level is, on average, from the group members' respective preferences for the joint effort. (Based on standard theory, preferred effort levels are identical, of course.)

[21] An alternative proxy for measuring expected agreement cost could be the likelihood that players were required to participate in a second round of chatting because they chose different values for the group effort. However, this happened too infrequently, in only 38 out of 692 chats, which makes it difficult to draw meaningful distinctions from such a limited sample size.

(compare the estimated coefficient of "group-group" in Table B4). Hence, even though the average effect of being part of a group is negative (in the sense of $\partial\delta_g/\partial n_G < 0$), these results on differences between conflict choices of groups and single players provide a first piece of evidence on the importance of non-monetary aspects of fighting in groups (Hypothesis 1).

Result 1. *In the group-group treatment, group members with high expected agreement costs are significantly less likely to trigger conflict than single players in the single-single treatment. In contrast, group players with low expected agreement costs are at least as likely (if not more likely) to choose conflict as single players.*

The results from the *group-group* treatment suggest that in an abstract setting with randomly formed groups for each interaction, the non-monetary (identity-based) utility of fighting in groups may be dominated by the fear of high cost of agreeing on fighting effort. The *group-choice* treatment allowed players to decide whether to keep or dissolve their group after a joint group experience. The manipulation provides comparative statics results on the non-monetary utility component of fighting in groups, which should be higher in maintained groups than in newly formed groups, for (at least) two reasons: first, the interaction in the contest stage may be perceived more positively by groups that formed endogenously. Second, the fact that a group decided to stay together should also reflect low agreement costs.[22] Estimation (3) in Table 2 provides support in favor of this idea summarized in Hypothesis 2: members of groups that have been maintained by choice opt for conflict with significantly higher probability than players in newly/randomly formed groups in the *group-choice* treatment (the estimated coefficient of the indicator variable "group-choice×same-partner" in estimation (3) is 1.478, p-value = 0.001). Moreover, players in endogenously maintained groups also choose conflict significantly more often than single players in *single-single* or players in *group-group*.[23] Finally, in estimation (1), the difference between the estimated coefficients of "group-choice" and "group-group" is statistically significant (p-value = 0.014) so that the propensity of conflict is higher in *group-choice* on average (unconditional on the group formation choice) than in *group-group*. All these observations provide supporting evidence for Hypothesis 2.

Result 2. *Members of maintained groups in the group-choice treatment are significantly more likely to choose conflict than (i) members of randomly formed groups (in both the group-choice and the group-group treatment) and (ii) single players in the single-single treatment.*

[22]Section 5 comes back to an analysis of the decision to stay together and resulting selection effects.

[23]The sum of the coefficients of "group-choice" and "group-choice×same-partner" in estimation (3) is significantly different from zero (p-value = 0.033). When running a specification like in (3) without separating players in *group-group* according to agreement cost, the sum of the coefficients of "group-choice" and "group-choice×same-partner" is significantly different from (the pooled) "group-group" (p-value < 0.001).

Further evidence on the importance of non-monetary factors of fighting in groups is obtained from the post-experimental questionnaire, which includes measures for the individual-specific "need-to-belong"[24] as well as the "joy-of-fighting."[25] While the variable measuring "joy-of-fighting" is expected to have a similar effect for members of groups and for single players, we expect players with a higher "need-to-belong" to be particularly likely to opt for conflict when they would enter the conflict in a group, whereas "need-to-belong" should have no effect for the conflict choice of single players. Correspondingly, estimation (4) of Table 2 interacts these two measures with a dummy variable "group-player."

In estimation (4), the estimated coefficient of "joy-of-fighting" is significant both for single players (p-value < 0.001) and for group players (sum of "joy-of-fighting" with its interaction with "group-player"; p-value < 0.001): for both a higher joy of fighting matters, but there is no difference in the effect between group and single players. More importantly, a higher "need-to-belong" does not (or only marginally) significantly affect the probability of opting for conflict for individuals who would enter the conflict as single players (estimated coefficient is 0.158, p-value $= 0.104$). For group players, however, the effect is considerably larger in size and more significant: the estimated coefficient of the sum of "need-to-belong" with its interaction with "group-player" is 0.452 and hence almost three times as high (p-value < 0.001). Moreover, there is a significant difference of the effect of "need-to-belong" for group and for single players as measured by "need-to-belong×group-player" (p-value $= 0.040$).[26]

These results support the argument that a non-monetary utility of fighting is generally important both for group players and for single players but that there is a component related to group identification that is, obviously, only relevant for group players. Those players with a strong "need to belong" and presumably a high utility of being part of a group are particularly likely to opt for conflict if (and only if) they would enter the fight in a group.

[24] A group-specific measure of the need-to-belong is obtained by the statement "If other people don't seem to accept me, I don't let it bother me." The participants answered on a scale from 0 to 10 where 0 means "Not at all like me" and 10 means "Exactly like me." The estimations use the reversed scale so that a higher value means a stronger need-to-belong. This survey question is taken from the need-to-belong score developed by Schreindorfer and Leary (1669) and used by Carvallo and Pelham (2006), De Cremer and Leonardelli (2003), Pickett et al. (2004), and others. The variable is, like all other control variables, normalized.

[25] Joy of fighting is measured based on the statement "I see myself as someone who enjoys competing, regardless of whether I win or lose." The participants answered on a scale from 0 to 10 where 0 means "Not at all like me" and 10 means "Exactly like me." This survey question is taken from Fallucchi et al. (2020). We explicitly picked this question because it fits best to our contest setting with chosen effort whereas other survey questions are more closely related to (skill-based) real effort competition.

[26] In estimation (5) which adds various control variables for individual characteristics and preferences, the interaction term "need-to-belong×group-player" is less significant (p-value $= 0.144$). Still, a higher need-to-belong has an insignificant effect on the conflict choice of single players (p-value $= 0.165$) whereas it has a larger and highly significant effect on the conflict choice of group players (p-value < 0.001).

Result 3. *Individuals with a higher (self-reported) non-monetary utility from fighting are more likely to opt for conflict, irrespective of fighting alone or in groups. Individuals with a higher (self-reported) utility from being in a group (need-to-belong) are more likely to opt for conflict if and only if they would fight in a group.*

After analyzing the role of non-monetary aspects of fighting in symmetric settings, we now turn to the results on asymmetric conflict.

Asymmetric conflict and perceived strength. Our main Hypothesis 3 on differences between group and single players in the *group-single* treatment is based on differences in perceived strength, which we will below proxy by an individual's expectation of the win probability in the contest. First of all, however, as shown in all estimations in Table 2, the estimated coefficients of the indicator variables "group-single(group)" and "group-single(single)" unanimously support Hypothesis 3: group players facing single players ("group-single(group)") are more likely to choose conflict than group players facing another group ("group-group").[27] Moreover, single players facing a group ("group-single(single)") are significantly less likely to choose conflict than single players facing another single player (estimated coefficient in estimation (1) is -3.681; p-value $= 0.002$). Hence, keeping the own group size constant, a change in the size of the opponent group has the predicted effect on the willingness to trigger conflict (compare Corollary 3 in Appendix A).

Result 4. *Group players in the group-single treatment are significantly more likely to choose conflict than group players in the group-group treatment. Single players in the group-single treatment are significantly less likely to choose conflict than single players in the single-single treatment.*

We further ask if the differences observed in the *group-single* treatment can be explained by differences in the perceived strength of groups and single players in an asymmetric conflict. Our measure of perceived strength is derived from an elicitation of the individual belief about the probability of winning the contest. This elicitation takes place after the participant's own conflict choice in stage 1, but before the choices of other players in stage 1 are revealed. Figure 2 displays histograms of the estimated win probabilities by group and single players in *group-single*. From the graph it is obvious that a large share of players expect their win probability to be at or around 50%. However, while estimated win probabilities below 50% are more frequent in *group-single(single)*, the opposite holds for *group-single(group)* where a substantial share of players expects their win probability to be above 50%. There appears

[27] The estimated coefficient of "group-single(group)" in estimation (1) is significantly different from the coefficient of "group-group" (p-value < 0.001).

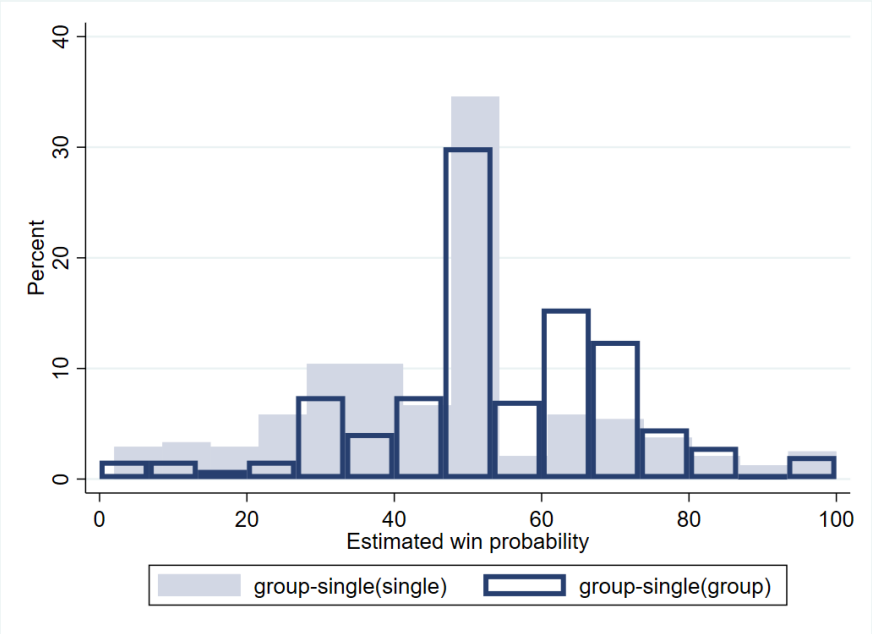

Figure 2: Estimated win probabilities in the asymmetric setting group-single

to be a noticeable disparity in the perceived strength between group players and individual players in an asymmetric conflict. This effect arises despite the fact that the actual (realized) win probability for groups and individual players in the *group-single* scenario is essentially identical, at 50.36% and 49.64% respectively. Figure B2 in Appendix B further illustrates the effects of the relative group size on the individual beliefs about the win probability by showing the distributions of beliefs across the symmetric and asymmetric setups.

Estimation (5) in Table 2 builds on this finding and includes the individuals' estimates of their win probability in the respective round ("win-probability(estimated)").[28] We find that a higher stated belief about the win probability increases the probability to trigger conflict. The estimated coefficients of the treatment effects *group-single(group)* and *group-single(single)*, however, only become sightly smaller in size and remain significant even when controlling for the individually anticipated win probability. This finding is confirmed when including different measures for the perceived strength such as the difference between the average estimated win probability and actual win probability (see Table B5 in Appendix B).

[28]Note that we only elicited beliefs about the win probability in 4 out of the 24 rounds in order to reduce the complexity of the overall task for the subjects. To avoid a substantial reduction in the sample and make the results comparable to the previous estimations, the variable is linearly extrapolated based on the elicited values for the rounds in which we did not elicit the individual estimate of the win probability. Basically the same results for this and all other effects are obtained when using an individual's average estimate of her win probability instead of the linear extrapolation. Even when restricting the sample to the 4 rounds in which the win probability was elicited, the effects are very similar, with a positive and significant effect of the estimated win probability (p-value < 0.001) and significant effects of "group-single(group)" and "group-single(single)".

Despite the evidence in favor of differences in perceived strength caused by the relative group size and its explanatory power for conflict choices, such differences do not fully explain the treatment effects of the *group-single* treatment. One reason may be that the elicited belief about the win probability is only an incomplete measure of how the players perceive their strength as result of group size advantages and disadvantages. For instance, the participants may think in simpler dimensions than estimated probabilities as numbers between 0 and 100. Another reason goes back to the theory assumption of δ_g being a function of the own group size only. One may speculate that the non-monetary utility from fighting also depends on whether one fights *against* a group or an individual. First of all, as previously noted, the status of belonging to a group versus being alone may be particularly salient in the context of an asymmetric conflict. In other words, the identity-based utility from fighting in groups might be larger when the feeling of being part of a group is strengthened due to the fact that others have to fight alone. Similarly, the non-monetary utility from fighting alone might be smaller when observing that others can fight in groups. More directly, δ_g may decrease in the size of the opponent group simply because group members derive a higher utility from fighting against–or have a lower non-monetary cost of targeting–single players than groups.[29] In our setting, while we can only speculate about such a dark side of human nature, such effects of the size of the opponent group on δ_g would yield a prediction in line with the experimental results in *group-single*.

Result 5. *Group size advantages cause an upward bias in the expected win probability in the contest. Moreover, individuals who expect a higher win probability in the stage 2 contest are more likely to opt for conflict. This, however, does not fully explain the treatment effects of asymmetric conflict (group-single).*

To conclude the analysis of conflict choices, estimation (5) in Table 2 adds as additional control variables all further measures elicited in the post-experimental questionnaire[30] and a proxy for a player's expected contest payoff. Whereas the experiment is designed such that the benchmark theory predicts identical expected contest payoffs for all players in all treatments, we expect to observe heterogeneity in the realized contest payoffs of different players due to the usual heterogeneity in observed effort choices. Since the conflict choices depend on what players expect their stage 2 payoff to be, we include a player's average experienced contest payoff in rounds 1 to 12 as a proxy for the contest payoff a player can

[29]Evidence for nasty behavior by groups was also found in other studies. E.g., Bauer et al. (2018) compare groups and individuals in a game of destruction and find that groups are more likely to behave anti-social.

[30]This includes age, gender, field of study, degree and previous experience in contest experiments, plus self-assessments of altruism, risk aversion, impulsiveness, joy of winning, spite, and comprehension of the instructions.

reasonably expect.[31] At the same time, this control is important if–other than predicted by theory–there are systematic treatment differences in the realized monetary contest payoffs. (The regression results in Table 3 in Section 5 below confirm, however, that the contest payoffs do not significantly differ across treatments.)

Estimation (5) shows that an individual's average realized payoff in rounds 1 to 12 has a significantly positive effect on the probability to choose conflict in the subsequent rounds (p-value = 0.003). Importantly, however, including this control variable does not affect the main treatment effects. Thus, while differences in the (expected) monetary incentive for conflict explain individual differences in conflict choices, such differences do not explain why group players generally opt for conflict more often.

Among the control variables from the post-experimental questionnaire, we find that individuals with a higher self-reported willingness to take risks and a higher self-reported joy of winning opt for conflict significantly more often, while more altruistic players opt for conflict significantly less often. Finally, women are significantly more likely to opt for conflict than men. Similar to Mago and Razzolini (2019) and Bruner et al. (2022), we find no gender differences in effort choices in the Tullock contest of stage 2.

5 Additional results

In this section, we supplement the main results on conflict choices presented in Section 4 with a brief analysis of the effort choices, the resulting contest payoffs, and the players' choices to stay together in the *group-choice* treatment.

Contest effort and payoffs. Previous experiments on Tullock contests have shown a tendency for players to exert higher-than-predicted effort and therefore realize a lower-than-predicted contest payoff. In our experiment, the average individual contest efforts in rounds 1 to 24 are above the prediction of $v_g/4 = 50$ as well; they range between 75 and 83 in the different treatments. Hence, the average individual contest payoffs are clearly below the predicted value of $v_g/4 = 50$ and range between 20 and 34 in the different treatments.

Table 3 examines possible treatment differences of effort choices and contest payoffs. In the first three estimations we regress effort choices as percentages of the prize (that is,

[31] Including this variable decreases the number of observations by 12 because one participant never entered the Tullock contest in the first 12 rounds. We obtain similar results when using alternative measures for experienced contest payoff such as the realized payoff in the previous contest played or the average payoff of all previously played contests; see Table B3 in Appendix B.

Table 3: Effort and contest payoffs across treatment

	effort/prize$_{it}$			contest-payoff/prize$_{it}$		
	(1)	(2)	(3)	(4)	(5)	(6)
	rounds 1-12	rounds 1-24	rounds 1-12	rounds 1-12	rounds 1-24	rounds 1-12
group-group	-3.506	-1.562		6.048	4.679	
	(4.434)	(4.893)		(4.397)	(4.309)	
group-choice	-2.368	-0.654	-4.715	2.765	1.607	5.568
	(3.786)	(3.248)	(3.981)	(4.033)	(3.392)	(5.024)
group-single(group)	-4.864	-2.400	-4.849	6.077	3.829	6.061
	(5.028)	(4.884)	(5.034)	(4.499)	(4.838)	(4.490)
group-single(single)	-4.427	-1.147	-4.425	3.740	1.249	3.745
	(4.385)	(4.019)	(4.374)	(6.738)	(6.533)	(6.746)
group-group(high-chat-time)			0.299			2.941
			(4.619)			(4.591)
group-group(low-chat-time)			-7.091			8.298*
			(4.640)			(4.723)
group-choice×same-partner			4.849***			-5.296
			(1.370)			(3.900)
Questionnaire controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	44.513***	42.003***	44.500***	4.917	7.013**	4.925
	(2.758)	(2.612)	(2.768)	(3.368)	(2.977)	(3.365)
Observations	2570	4707	2570	2570	4707	2570

Mixed-effects linear regressions. Random intercepts at the subject level. Standard errors in parentheses, clustered at the level of matching groups. In estimations (1) to (3), the dependent variable "effort/prize$_{it}$" equals the contest effort expended by individual i in % of her prize value. In estimations (4) to (6), the dependent variable "contest-payoff/prize$_{it}$" equals individual i's realized contest payoff in % of her prize value. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

$X_G/V = x_g/v_g$) on treatment dummies and control variables, based on linear mixed models and separately for rounds 1 to 12 (estimation (1)), 1 to 24 (estimation (2)), and again rounds 1 to 12 (estimation (3)) with treatment groups further separated as in the main regression in Table 2. The constant refers to the average effort in the baseline category *single-single*, which is, on average in rounds 1 to 24, equal to 42.0% of the prize value and thus clearly above the prediction of 25%. None of the treatment differences is significantly different from zero. One exception is the significantly higher effort in endogenously maintained groups (compare the interaction of "group-choice" and "same-partner" in estimation (3)). This higher effort tends to reduce monetary payoffs (compare estimation (6)) so that the higher conflict rate in endogenously maintained groups cannot be due to monetary incentives.

Similarly, estimations (4) to (6) test treatment differences in realized contest payoffs; none of the treatment effects is significantly different from zero either. Thus, the observed treatment

differences in conflict choices (e.g., in late rounds as in the regression in Table 2) cannot be explained by systematic differences in contest payoffs in early rounds (e.g., rounds 1 to 12) and resulting differences in the players' expectations. Instead, the low realized contest payoff (e.g., 10.97% of the prize value in rounds 1 to 12 of the *group-group* treatment) together with a substantial share of players rejecting the outside option (which would be 26% of the prize value) confirm the importance of non-monetary factors for explaining the conflict choices.

The choice of staying together. One of our main results shows that group players who played with the same partner as in the previous round are significantly more likely to choose conflict than group players with randomly matched new partners. This section analyzes the determinants of the group players' choices to maintain their group in the *group-choice* treatment. If stable groups are more conflict-prone, what makes a group stable?

A first piece of evidence is obtained from replies to a post-experimental question on possible motivations for staying with their group partner. A majority of the participants of the *group-choice* treatment indicated that they chose to stay with their partner either because they thought they were a good team (43%) or because their partner wanted a similar effort (31%); compare Figure B3 in Appendix B. This supports the conjecture that the decision to maintain the group may indeed depend on positive group experience in the contest, as well as the easiness to agree on a joint effort.

Table 4 presents an analysis of determinants of the group composition choice. The dependent variable "stay$_{it}$" is individual i's decision in round t to maintain the group in the next round. It is equal to 1 if a player decided to stay with the existing group partner after a joint contest stage and is 0 if she decided to be randomly assigned to a new partner. Estimations (1) and (2) consider the impact of the group's success in the contest. We find that a higher joint group effort significantly increases the probability that the group stays together (estimation (1); p-value = 0.003). Similarly, a higher expected contest payoff leads to a higher probability of staying together (estimation (2); p-value = 0.040). For the latter, we use the expected payoff as the explanatory variable, that is, the payoff conditional on both contestants' effort choices but unconditional on the realization of the contest outcome, which is not yet known when the players decide on whether to maintain their group. Despite the higher cost of effort, a higher conflict intensity may increase the connection between the group members because they are committing and risking more for the group.[32] This as well as the expected

[32] Allowing for a non-linear effect of the group effort and adding a squared term for effort does not change the conclusions (the squared term is insignificant). We do not jointly include group effort and expected payoff as explanatory variables since in this case the latter would capture effects of the (not yet known) effort of the rival group.

Table 4: Individual decision to maintain the group

	(1) $stay_{it}$	(2) $stay_{it}$	(3) $stay_{it}$	(4) $stay_{it}$	(5) $stay_{it}$
effort	0.005***		0.005***	0.004**	0.001
	(0.002)		(0.002)	(0.002)	(0.002)
exp-contest-payoff		0.006**			
		(0.003)			
own-conflict-choice			1.223***	0.682**	0.487*
			(0.259)	(0.273)	(0.276)
same-conflict-choice				1.548***	1.335***
				(0.212)	(0.216)
same-partner					1.792***
					(0.252)
chat-time					-0.017***
					(0.006)
chat-time×same-partner					0.036***
					(0.014)
Questionnaire controls	Yes	Yes	Yes	Yes	Yes
Constant	0.730**	0.964**	-0.036	-0.451	-0.477
	(0.369)	(0.378)	(0.398)	(0.401)	(0.397)
Observations	1116	1116	1116	1116	1116

Mixed effects logistic regressions. Random intercepts at the subject level. Standard errors in parentheses, clustered at the level of matching groups. Data from rounds 1 to 24 of the *group-choice* treatment. The dependent variable "$stay_{it}$" is equal to 1 if individual i opted for staying together with the same group partner in round t, and is zero if i opted for a new partner. "effort" is the joint effort which i and her partner agreed on in round t. "exp-contest-payoff" equals i's expected contest payoff in round t (based on effort choices in this round). "own-conflict-choice" equals 1 if i opted for conflict in stage 1 of round t, and zero otherwise. "same-conflict-choice" equals 1 if i and her group partner opted for the same option (conflict or outside option), and zero otherwise. "chat-time" equals the time subject i spent on discussing the group effort in round t. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

payoff may be perceived as successful collaboration and hence make groups more stable.

Next, we take into account a player's conflict choice in stage 1 of the round. Estimation (3) in Table 4 shows that players who opt for conflict are more likely to maintain their group (variable "own-conflict-choice"; p-value < 0.001). This still holds when controlling for the other group member's choice: estimation (4) adds a dummy variable "same-choice" that is equal to 1 if both group members opted for the same option in stage 1 (conflict or outside

option) and is equal to 0 otherwise. We find that group members with the same stated conflict preference in stage 1 are more likely to stay together (p-value < 0.001). Adding this variable weakens the effect of the own conflict choice (now measuring the effect for players who preferred conflict in a situation with diverging preferences), which becomes smaller in size and somewhat less significant (p-value $= 0.012$). Both effects are important for understanding the results of the *group-choice* treatment. First, endogenous group formation leads to a selection of groups where group members share similar preferences and hence possibly a lower cost of agreement. Second, more conflict-prone players–with possibly a higher non-monetary utility of fighting in groups–are more likely to opt for maintaining their group. Both types of selection effects can explain the higher conflict rates in endogenously maintained groups.

Further evidence on the importance of selection according to non-monetary aspects of fighting in groups is obtained in estimation (5) in Table 4, which directly adds a proxy for the experienced cost of agreement in a given round. The variable "chat-time" measures the time spent discussing the group effort in the round under consideration, before making the choice on whether to maintain or dissolve the group. We additionally interact this variable with a dummy variable "same-partner" which indicates whether individual i plays together with the same group partner as in the previous round. The reason for this interaction is the following: Chatting with the partner might, on the one hand, serve the purpose of finding and agreeing on a joint effort and thus be costly for group players. On the other hand, it may serve as a platform for exchange and interaction and may strengthen the connection between group players, especially when players repeatedly chat with the same partner and do not have to argue much about the group effort anymore. The significant coefficient of "same-partner" shows that, perhaps not surprisingly, groups that existed previously and were maintained by choice are more likely to remain together.[33] More importantly, the estimated coefficient of "chat-time" is negative (p-value $= 0.004$), measuring the effect of higher agreement costs in newly formed groups (where "same-partner" is zero). In contrast, the interaction of "chat-time" with "same-partner" is significantly positive (p-value $= 0.008$) and the sum of "chat-time" with this interaction is positive but insignificant (p-value $= 0.133$). Together, this confirms the conjecture that, while higher chat time spent on finding an agreement for the first time might be perceived as costly and hence reduces the probability of maintaining the group, chat time spent in repeated interactions is not perceived as costly (or costs might

[33]The effect of the group effort becomes weaker and insignificant when controlling for "same-partner." An explanation is that effort choices are higher in existing groups (compare Table 3) so that "same-partner" may pick up part of the effect of higher effort.

have been partially compensated by benefits from repeated interactions).[34]

In summary, we find various evidence that a positive group experience favors decisions to maintain the group. This holds especially for groups sharing a similar propensity to trigger conflict and for those groups that find it easier to agree and mobilize effort in the contest. Together with the previous finding that groups that were maintained choose conflict more often and mobilize higher conflict effort, commitment in the conflict and stability of groups appear to reinforce each other, with negative welfare consequences (lower total payoffs).

6 Conclusion

We examined how the involvement of rival groups in distributional conflict affects individual behavior toward conflict initiation. Do individuals get more prone to conflict when they would fight as part of a group? And does the individual conflict decision depend on whether one faces a group or a single player as opponent? Our experiment shows that, overall, the status of fighting in a group increases the individual propensity to choose conflict even when it does not affect the monetary gains or losses to be anticipated from the conflict. Key insights from our analysis are as follows.

For symmetric conflict settings (groups against groups or single players against single players), we find countervailing effects of fighting in groups. One the one hand, a (non-monetary) cost of reaching agreement in groups deters group players from triggering conflict: players who experienced high cost of reaching agreement within their group are significantly less likely to opt for conflict than single players. On the other hand, fighting (interacting) in groups makes the individuals more conflict-prone especially when they express a desire to belong to groups or when the institutional environment allows for a stronger group identification. On the former, we find that individuals who indicate a higher subjective importance of being part of a group (a higher "need to belong") are more inclined to opt for conflict when they are part of a group (but not when they would have to fight as single players). On the latter, we show that group players in endogenous groups (maintained by choice of the group members) are more likely to opt for conflict than group players in newly matched groups or than single players. At the same time, positive joint experience in previous conflicts such as a high mobilization of efforts, higher payoffs or lower cost of agreement significantly increases the likelihood that players want to maintain their group. These two effects reinforce each other and lead to high conflict rates in a setting in which players have the choice

[34]Similar effects are obtained for the effect of agreement costs on conflict choices as shown in estimation (3) of Table B4 where agreement costs have a differential effect in *group-group* versus *group-choice*.

to maintain or dissolve their group. To put it simple, stable groups cause more conflict, and a joint and successful conflict experience makes groups more stable.

For asymmetric conflict settings (groups against single players), we find that the relative size of the opponent group matters: group players facing single players as opponents are more likely to opt for conflict than group players facing another group. Inversely, single players facing a group are less likely to opt for conflict than single players facing another single player. Size advantages (disadvantages) leads to overly optimistic (pessimistic) beliefs about the win probability, which lead group players to attacking single players and makes single players shy away from attacking groups. Differences in expected win probabilities do not, however, fully explain the differences in the observed conflict rates in asymmetric conflict.

Overall, we can conclude that the involvement of groups in conflict settings does not improve social outcomes but mostly makes a cooperative peaceful solution less likely. Our results provide insights into conditions and environments that make it more likely to maintain peace when groups are involved. First, selection into groups facilitates group decision-making and reduces agreement costs and hence strengthens the individual willingness to attack others. Vice-versa, supporting heterogeneity in groups or introducing more complex agreement processes could deter groups from engaging in conflict. Second, asymmetry in group size seems to play an important role for hampering peaceful outcomes even in situations where this asymmetry does not provide any strategic advantage. Our results suggest not only a bias in the perceived strength when outnumbering the opponent group. There also seems to be a general tendency for groups to attack single players, possibly because of a stronger identity-based utility when group membership becomes more salient. Finally, breaking up long maintained groups and supporting the formation of new groups could make individuals in groups less agitated and reduce conflict initiation. More generally, being an important decision per se and also explaining selection effects, our study shows that the initial decision toward conflict should receive more attention in the (economic) analysis of conflict.

References

Abbink, K., Brandts, J., Herrmann, B., and Orzen, H. (2010). Intergroup conflict and intra-group punishment in an experimental contest game. *American Economic Review*, 100(1):420–447.

Ahn, T. K., Isaac, R. M., and Salmon, T. C. (2011). Rent seeking in groups. *International Journal of Industrial Organization*, 29:116–125.

Akerlof, G. A. and Kranton, R. E. (2000). Economics and identity. *Quarterly Journal of Economics*, 115(3):715–753.

Baik, K. H., Chowdhury, S. M., and Ramalingam, A. (2021). Group size and matching protocol in contests. *Canadian Journal of Economics*, 54(4):1716–1736.

Bauer, M., Cahlikova, J., Dagmara, C. K., Chytilová, J., Cingl, L., and Zelinsky, T. (2018). Nastiness in groups. *Working Paper of the Max Planck Institute for Tax Law and Public Finance*, No. 2018-14, Available at SSRN: `https://ssrn.com/abstract=3283686`.

Baumeister, R. F. and Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, 117(3):497–529.

Bhattacharya, P. (2016). Inter-team contests with power differential. *Journal of Economic Behavior and Organization*, 132:157–175.

Blattman, C. and Miguel, E. (2010). Civil war. *Journal of Economic Literature*, 48(1):3–57.

Brookins, P., Lightle, J. P., and Ryvkin, D. (2015). An experimental study of sorting in group contests. *Labour Economics*, 35:16–25.

Brookins, P., Lucas, A., and Ryvkin, D. (2014). Reducing within-group overconfidence through group identity and between-group confidence judgments. *Journal of Economic Psychology*, 44:1–12.

Bruner, D., Cox, C., McEvoy, D. M., and Stoddard, B. (2022). Strategic thinking in contests. *Experimental Economics*, 25:942–973.

Carvallo, M. and Pelham, B. W. (2006). When fiends become friends: The need to belong and perceptions of personal and group discrimination. *Journal of Personality and Social Psychology*, 90(1):94–108.

Charness, G., Rigotti, L., and Rustichini, A. (2007). Individual behavior and group membership. *American Economic Review*, 97(4):1340–1352.

Charness, G. and Sutter, M. (2012). Groups make better self-interested decisions. *Journal of Economic Perspectives*, 26(3):157–176.

Chen, D. L., Schonger, M., and Wickens, C. (2016). oTree – An open-source platform for laboratory, online, and field experiments. *Journal of Behavioral and Experimental Finance*, 9:88–97.

Chen, Y. and Li, S. X. (2009). Group identity and social preferences. *American Economic Review*, 99(1):431–457.

Chowdhury, S. M., Jeon, J. Y., and Ramalingam, A. (2016). Identity and group conflict. *European Economic Review*, 90:107–121.

De Cremer, D. and Leonardelli, G. J. (2003). Cooperation in social dilemmas and the need to belong: The moderating effect of group size. *Group Dynamics: Theory, Research, and Practice*, 7(2):168–174.

Dechenaux, E., Kovenock, D., and Sheremeta, R. M. (2015). A survey of experimental research on contests, all-pay auctions and tournaments. *Experimental Economics*, 18:609–669.

Esteban, J. and Ray, D. (2001). Collective action and the group size paradox. *American Political Science Review*, 95(3):663–672.

Fallucchi, F., Fatas, E., Kölle, F., and Weisel, O. (2021). Not all group members are created equal: Heterogeneous abilities in inter-group contests. *Experimental Economics*, 24:669–697.

Fallucchi, F., Nosenzo, D., and Reuben, E. (2020). Measuring preferences for competition with experimentally-validated survey questions. *Journal of Economic Behavior and Organization*, 178:402–423.

Fershtman, C. and Gneezy, U. (2001). Discrimination in a segmented society: An experimental approach. *Quarterly Journal of Economics*, 116(1):351–377.

Healy, A. J. and Pate, J. G. (2007). Overconfidence, Social Groups, and Gender: Evidence from the Lab and Field. *SSRN Electronic Journal*, Available at `https://ssrn.com/abstract=934320`.

Heap, S. P. and Zizzo, D. J. (2009). The value of groups. *American Economic Review*, 99(1):295–323.

Herbst, L., Konrad, K. A., and Morath, F. (2015). Endogenous group formation in experimental contests. *European Economic Review*, 74:163–189.

Herbst, L., Konrad, K. A., and Morath, F. (2017). Balance of power and the propensity of conflict. *Games and Economic Behavior*, 103:168–184.

Hoelzl, E. and Rustichini, A. (2005). Overconfident: Do you put your money on it? *Economic Journal*, 115(503):305–318.

Huck, S., Konrad, K. A., Müller, W., and Normann, H. T. (2007). The merger paradox and why aspiration levels let it fail in the laboratory. *Economic Journal*, 117(522):1073–1095.

Jackson, M. O. and Morelli, M. (2011). The Reasons for Wars: An Updated Survey. In Coyne, C. J. and Mather, R. L., editors, *The Handbook on the Political Economy of War*. Edward Elgar, Cheltenham, UK.

Ke, C., Konrad, K. A., and Morath, F. (2013). Brothers in arms - An experiment on the alliance puzzle. *Games and Economic Behavior*, 77(1):61–76.

Ke, C., Konrad, K. A., and Morath, F. (2015). Alliances in the shadow of conflict. *Economic Inquiry*, 53(2):854–871.

Kimbrough, E. O., Rubin, J., Sheremeta, R. M., and Shields, T. W. (2015). Commitment problems in conflict resolution. *Journal of Economic Behavior and Organization*, 112:33–45.

Kimbrough, E. O. and Sheremeta, R. M. (2014). Why can't we be friends? Entitlements and the costs of conflict. *Journal of Peace Research*, 51(4):487–500.

Kimbrough, E. O., Sheremeta, R. M., and Shields, T. W. (2014). When parity promotes peace: Resolving conflict between asymmetric agents. *Journal of Economic Behavior and Organization*, 99:96–108.

Kugler, T., Kausel, E. E., and Kocher, M. G. (2012). Are groups more rational than individuals? A review of interactive decision making in groups. *Wiley Interdisciplinary Reviews: Cognitive Science*, 3(4):471–482.

Lacomba, J. A., Lagos, F., Reuben, E., and van Winden, F. (2014). On the escalation and de-escalation of conflict. *Games and Economic Behavior*, 86:40–57.

Leary, M. R. (1999). Making sense of self-esteem. *Current Directions in Psychological Science*, 8(1):1997–2000.

Mago, S. D. and Razzolini, L. (2019). Best-of-five contest: An experiment on gender differences. *Journal of Economic Behavior and Organization*, 162:164–187.

McBride, M. and Skaperdas, S. (2014). Conflict, settlement, and the shadow of the future. *Journal of Economic Behavior and Organization*, 105:75–89.

Miettinen, T., Ropponen, O., and Sääskilahti, P. (2020). Prospect theory, fairness, and the escalation of conflict at a negotiation impasse. *Scandinavian Journal of Economics*, 122(4):1535–1574.

Moore, D. A. and Healy, P. J. (2008). The trouble with overconfidence. *Psychological Review*, 115(2):502–517.

Olson, M. (1965). *The Logic of Collective Action*. Harvard University Press, Cambridge, MA.

Pickett, C. L., Gardner, W. L., and Knowles, M. (2004). Getting a cue: The need to belong and enhanced sensitivity to social cues. *Personality and Social Psychology Bulletin*, 30(9):1095–1107.

Plous, S. (1995). A comparison of strategies for reducing interval overconfidence in group judgments. *Journal of Applied Psychology*, 80(4):443–454.

Schreindorfer, L. S. and Leary, M. R. (1669). Seeking acceptance versus avoiding rejection: Differential effect on emotion and behavior. In *Paper presented at the Meeting of the Southeastern Psychological Asscociation*, Norfolk, VA.

Sheremeta, R. M. (2013). Overbidding and heterogeneous behavior in contest experiments. *Journal of Economic Surveys*, 27(3):491–514.

Sheremeta, R. M. (2018). Behavior in group contests: A review of experimental research. *Journal of Economic Surveys*, 32(3):683–704.

Sheremeta, R. M. and Zhang, J. (2010). Can groups solve the problem of over-bidding in contests? *Social Choice and Welfare*, 35:175–197.

Sherif, M., Harvey, O. J., White, J., Hood, W. R., and Sherif, C. W. (1961). *Intergroup Conflict and Cooperation: The Robbers Cave Experiment*. Institute of Group Relations University of Oklahoma, University Book Exchange, Norman, OK.

Smith, A. C., Houser, D., Leeson, P. T., and Ostad, R. (2014). The costs of conflict. *Journal of Economic Behavior and Organization*, 97:61–71.

Tajfel, H. (1974). Social identity and intergroup behaviour. *Social Science Information*, 13(2):65–93.

Tajfel, H. and Turner, J. (2004). An Integrative Theory of Intergroup Conflict. In Hatch, M. J. and Schultz, M., editors, *Organizational Identity: A Reader*. Oxford University Press, New York.

Tullock, G. (1980). Efficient Rent Seeking. In Buchanan, J. M., Tollison, R. D., and Tullock, G., editors, *Toward a Theory of the Rent-seeking Society*. Texas A&M University Press, College Station, TX.

Wittman, D. (1979). How a war ends. *Journal of Conflict Resolution*, 23(4):743–763.

A Extended theory framework

Consider the game described in Section 2 but suppose the players also care about aspects of fighting beyond monetary payoffs, summarized by a *non-monetary utility component* $\delta_g \in \mathbb{R}$ of fighting. This non-monetary utility may be a function of the group size, that is, $\delta_g = \delta_g(n_G)$, and hence be different when fighting in groups than when fighting alone.[35]

Moreover, to address asymmetric conflict in particular, the extended framework allows for a *misperception of the true win probability*. Denoting by $\tilde{p}_G$ the subjective belief about the win probability for the members of group $G \in \{A, B\}$, we assume that $\tilde{p}_A = w(p)$ where p is the objective win probability of group A given in (1) and w is a strictly increasing and (weakly) concave function. Members of group B believe to win with probability $\tilde{p}_B = 1 - w(p)$.[36] Taking into account the possibility of group size effects, the individual perception w is allowed to be a function of the number of players in groups A and B, that is, $w = w(p; n_A, n_B)$. To illustrate, if $w(p) > p$, members of the larger group A overestimate their chances of winning for given efforts, whereas the smaller group B then believes that $\tilde{p}_B = 1 - w(p) < 1 - p$, that is, underestimates their chances of winning for given efforts. To avoid systematic group differences in case groups are symmetric, we assume that $w(p) = p$ if $n_A = n_B$.

Altogether, members a of group A maximize their *subjective* expected payoff $E[\tilde{\pi}_g]$ (as opposed to the monetary payoff π_g) given by

$$E[\tilde{\pi}_a] = w(p)\, v_a + \delta_a - \frac{X_A}{n_A}. \tag{5}$$

Members b of group B maximize their subjective expected payoff

$$E[\tilde{\pi}_b] = (1 - w(p))\, v_b + \delta_b - \frac{X_B}{n_B}. \tag{6}$$

Proposition 2. *Consider the stage 2 contest and suppose that all players $g \in G$ maximize their subjective expected payoff given in (5) and (6), respectively, $G = A, B$. Then, equilibrium efforts are*

$$X_A^* = X_B^* = \left.\frac{\partial w}{\partial p}\right|_{p=\frac{1}{2}} \frac{V}{4}. \tag{7}$$

[35] Equivalently, one could allow δ_g to be a function of the size of the rival group, with analogous theoretical implications. We discuss such a possibility in the context of the main experimental results.

[36] This symmetry in misperceptions of win probabilities is convenient since it implies a consistency of the two contestants' beliefs about their own and the opponent's win probability. Asymmetric weighting functions w_G can be analyzed along the same lines but require an assumption on what weighting a group believes the other group to apply.

Proof. Maximization of (5) and (6) with respect to X_A and X_B, respectively, yields the first-order conditions[37]

$$\frac{\partial w(p)}{\partial p}\frac{X_B}{(X_A+X_B)^2}\frac{V}{n_A}-\frac{1}{n_A}=0$$

and

$$-\frac{\partial w(p)}{\partial p}\left(-\frac{X_A}{(X_A+X_B)^2}\right)\frac{V}{n_B}-\frac{1}{n_B}=0.$$

Thus, $X_A^*=X_B^*$ and, hence, $p^*=1/2$ in equilibrium. If $w(p)>p$, however, the larger group expects to win with probability $\tilde{p}_A>1/2$ and the smaller group expects to win with probability $\tilde{p}_B<1/2$. Inserting $X_A=X_B$ into the first-order conditions yields (7).

□

The symmetry assumption on how groups A and B perceive their win probability implies that, in case of identical effort choices, the members of both groups believe the marginal impact of higher effort on their win probability to be the same even when an advantage in group size leads to an upward bias $w(p)>p$. Therefore, total equilibrium efforts in (7) are the same for both groups but may be higher or lower than the Nash equilibrium efforts (2) in the benchmark Proposition 1. Concretely, equilibrium efforts under biased perceptions of win probabilities are higher than $V/4$ if and only if $\partial w/\partial p>1$ at the symmetric equilibrium. Intuitively, as in the benchmark case, the equilibrium effort balances marginal gain (marginal win probability multiplied with the prize value) and marginal effort cost (which is equal to one). In the benchmark case, the marginal win probability is $1/(4X)$ at the symmetric equilibrium; here, it is $(\partial w/\partial p)/(4X)$. Thus, equilibrium effort is higher than in the benchmark case if and only if players overestimate the marginal impact of their effort on the win probability at the symmetric equilibrium.

Subjective expected equilibrium payoffs $E[\tilde{\pi}_g]$ and hence conflict preferences may depend on the group sizes to the extent that the non-monetary utility from fighting (δ_g) and/or the misperception of the win probability (w) depend on n_A and n_B. In line with the main treatment comparisons in the experiment, the first comparative statics result focuses on the non-monetary utility from fighting, keeping constant a possible misperception of the win probability. This addresses symmetric conflict in particular where we do not expect a systematic difference in perceived strength.

Corollary 2. *Let $n_A=n_B=n$. Holding the individual prize share $v_g=V/n_G$ and the outside option b_g constant, an increase in n strengthens the incentive of player $g\in\{a,b\}$ to*

[37] Second-order conditions hold due to weak concavity of w.

trigger conflict if and only if $\partial\delta_g/\partial n_G > 0$.

With (5) and (6), Corollary 2 follows directly from the fact that $\partial X_G/\partial n_G = 0$ if $w(p) = p$ as in symmetric conflict. Thus, neither monetary contest payoffs nor subjective win probabilities are affected by mutual changes in the group size, e.g., when comparing $n_A = n_B = 2$ to $n_A = n_B = 1$. But the subjective gain from conflict is affected by changes in the group size to the extent that changes in n_G affect the non-monetary utility δ_g from fighting. Our main hypotheses are based on the assumption that δ_g may differ when players fight in groups ($n_G > 1$), compared to fighting as single player ($n_G = 1$). If the non-monetary utility from fighting is higher in groups ($\partial\delta_g/\partial n_G > 0$), this would yield a stronger incentive to trigger conflict for groups as opposed to single players, and vice-versa in case of $\partial\delta_g/\partial n_G < 0$.

The second comparative statics result relates to the channel of a misperception of the win probability, keeping constant the utility δ_g from fighting. As with the treatment comparisons where we control for the own group size in order to control for such a group-specific utility component, the theory prediction employs variations in the size of the opponent group.

Corollary 3. *An increase in the size* n_{-G} *of the opponent group reduces the incentive of player* $g \in \{a, b\}$ *to trigger conflict if and only if*

$$\left.\frac{\partial\tilde{p}_G}{\partial n_{-G}}\right|_{p=\frac{1}{2}} < \frac{1}{4}\left.\frac{\partial^2 w}{\partial p\partial n_{-G}}\right|_{p=\frac{1}{2}}. \tag{8}$$

Proof. Keeping the own group size fixed and varying the relative group size through the size of the opponent group keeps the non-monetary utility δ_g constant. Thus, with

$$E\left[\tilde{\pi}_g\right] = \tilde{p}_G v_g + \delta_g - \frac{X_G}{n_G}, \tag{9}$$

and X_G given in (7), we obtain

$$\frac{\partial E\left[\tilde{\pi}_g\right]}{\partial n_{-G}} = \frac{\partial\tilde{p}_G}{\partial n_{-G}}v_g - \frac{\partial\tilde{p}_G}{\partial p}\frac{\partial p}{\partial n_{-G}}v_g - \frac{\partial^2 w}{\partial p\partial n_{-G}}\frac{v_g}{4}.$$

In words, subjective expected conflict payoff $E\left[\tilde{\pi}_g\right]$ changes in n_{-G} due to a direct effect on the subjective win probability $\tilde{p}_G$ (the first term), an indirect effect if the objective win probability p changes (the second term), and another indirect effect if the cost of effort changes (the third term). In equilibrium, $X_A = X_B$ holds independent of (changes in) w, which implies $\partial p/\partial n_{-G} = 0$. (The objective win probability remains equal to 1/2 since both contestants' efforts change in the same way.) Thus, in equilibrium, $\partial E\left[\tilde{\pi}_g\right]/\partial n_{-G} < 0$ if and

only if (8) holds. For group A, (8) is equivalent to

$$\left.\frac{\partial w}{\partial n_B}\right|_{p=\frac{1}{2}} < \frac{1}{4}\left.\frac{\partial^2 w}{\partial p \partial n_B}\right|_{p=\frac{1}{2}} \tag{10}$$

where the left-hand side of (10) is negative. For group B, (8) is equivalent to

$$\left.\frac{\partial w}{\partial n_A}\right|_{p=\frac{1}{2}} > -\frac{1}{4}\left.\frac{\partial^2 w}{\partial p \partial n_A}\right|_{p=\frac{1}{2}} \tag{11}$$

where the left-hand side of (11) is positive. □

Altogether, in this simple extension of the benchmark model, changes in the (relative) group size may have three effects on the (subjective) expected contest payoff ($E[\tilde{\pi}_g]$) for a member of group G. Apart from the direct effect on the non-monetary utility from fighting (Corollary 2), there is another direct as well as an indirect effect on the subjective equilibrium payoff $E[\tilde{\pi}_g]$. As the second direct effect, if an increase in the relative group size makes members of the group with size advantages more optimistic and members of the group with size disadvantages more pessimistic regarding their chances of winning for given efforts, this directly changes what the groups expect to be able to win in the conflict: the advantaged (disadvantaged) group expects a larger (smaller) gain from conflict.

There is, however, also an indirect effect of changes in the misperception of the win probability: equilibrium effort can increase or decrease depending on whether $\partial^2 w/\partial p \partial n_G|_{p=1/2}$ is positive or negative, that is, depending on how the change in the size of one of the groups changes the slope of the weighting function w of the true win probability.[38] Under condition (8) in Corollary 3, the direct effect of a reduction in the perceived win probability dominates the indirect effect of a change in the effort cost caused by changes in w. (This condition is, hence, always fulfilled if $\partial^2 w/\partial p \partial n_{-G}|_{p=1/2} > 0$ so that equilibrium efforts go up and the direct and indirect effect of an increase in the size of the opponent group work in the same direction.) If (8) holds, an increase in the relative group size increases the subjective contest payoff of the larger group and decreases the subjective contest payoff of the smaller group.

[38] In line with the general intuition in contests that efforts are highest if the players are symmetric, one may intuitively expect that an increase in the relative group size changes the perceived win probabilities in a way that equilibrium efforts go down. An example for such a case exhibiting $\partial^2 w/\partial p \partial n_A|_{p=1/2} < 0$ and $\partial^2 w/\partial p \partial n_B|_{p=1/2} > 0$ is $w(p; n_A, n_B) = p^{n_B/n_A}$.

B Additional figures and tables[39]

B.1 Overview of the experimental sessions

Table B1: Number of participants and sessions

	#Subjects	#Sessions	#Matching groups
single-single	80	4	6
group-group	96	4	8
group-choice	72	6	6
group-single	120	6	6
Total	368	20	26

B.2 Time series of conflict choices

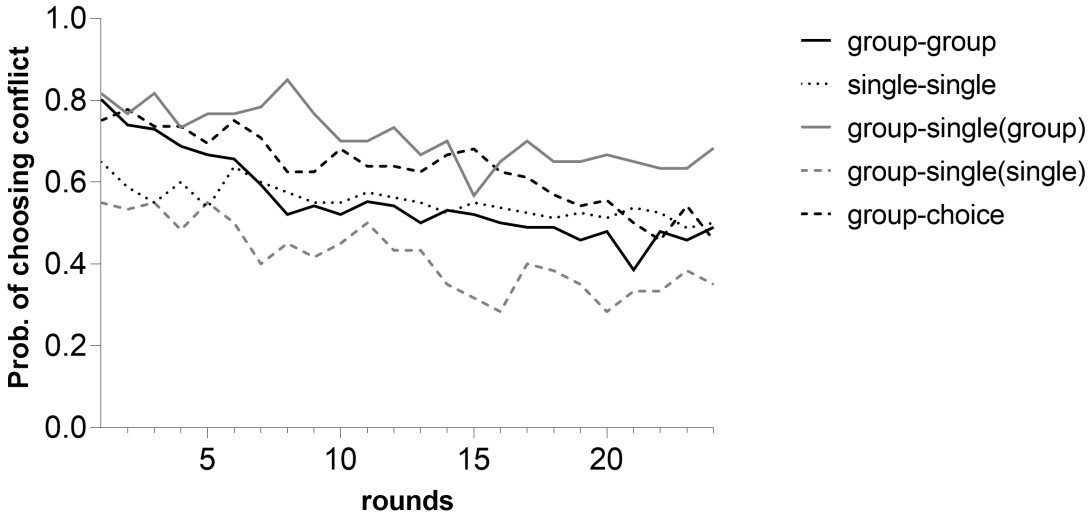

Figure B1: Share of individuals who opt for conflict across the rounds

[39]Figures in this paper were created using Stata16 and GraphPad Prism 8.4

B.3 Individual conflict choices: rounds 1 to 24

Table B2: Individual decision to opt for conflict: data from all rounds

	(1) conflict$_{it}$	(2) conflict$_{it}$	(3) conflict$_{it}$	(4) conflict$_{it}$	(5) conflict$_{it}$
group-group	-0.077				
	(0.625)				
group-choice	0.448	0.448	-0.143	-0.143	-0.299
	(0.521)	(0.522)	(0.530)	(0.475)	(0.470)
group-single(group)	1.265**	1.256**	1.254**	1.225***	1.024**
	(0.496)	(0.497)	(0.497)	(0.468)	(0.509)
group-single(single)	-1.607***	-1.585***	-1.579***	-1.569***	-1.498***
	(0.466)	(0.467)	(0.467)	(0.449)	(0.513)
group-group(high-chat-time)		-1.224*	-1.220*	-1.113**	-0.987*
		(0.633)	(0.634)	(0.557)	(0.550)
group-group(low-chat-time)		1.092*	1.089*	0.958*	0.596
		(0.563)	(0.563)	(0.574)	(0.569)
group-choice×same-partner			1.480***	1.483***	1.459***
			(0.159)	(0.165)	(0.168)
joy-of-fighting				0.340***	0.194**
				(0.099)	(0.088)
joy-of-fighting×group-player				-0.062	-0.031
				(0.099)	(0.088)
need-to-belong				0.098	0.125*
				(0.082)	(0.073)
need-to-belong×group-player				0.155*	0.099
				(0.090)	(0.085)
win-probability					0.038***
					(0.006)
contest-payoff(rounds1-12)					0.005*
					(0.003)
Questionnaire controls	No	No	No	No	Yes
Constant	0.685*	0.675*	0.673	0.667*	-1.241***
	(0.409)	(0.410)	(0.410)	(0.389)	(0.420)
Observations	8832	8832	8832	8832	8808

Mixed-effects logistic regressions. Random intercepts at the subject level. Standard errors in parentheses, clustered at the level of matching groups. Data from rounds 1-24. The dependent variable "conflict$_{it}$" is equal to 1 if individual i opted for conflict in round t. The variable "need-to-belong" is based on the questionnaire statement "If other people don't seem to accept me, I don't let it bother me."(scale 0-10, reversed). "joy-of-fighting" is based on the statement "I see myself as someone who enjoys competing, regardless of whether I win or lose."(scale 0-10). "contest-payoff(rounds1-12)" is i's average realized contest payoff in rounds 1-12. Including this variable in estimation (5) decreases the number of observations because one participant never entered the Tullock contest in rounds 1-12. "win-probability(estimated)" is i's estimate of her win probability in the contest. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B.4 Conflict choices conditional on stage 2 payoff

Table B3: Individual decision to opt for conflict: contest payoff

	(1) conflict_{it}	(2) conflict_{it}	(3) conflict_{it}
group-group	-1.120*	-1.162*	-1.157*
	(0.620)	(0.606)	(0.635)
group-choice	0.324	0.298	0.312
	(0.486)	(0.487)	(0.488)
group-single(group)	1.564***	1.508***	1.510***
	(0.524)	(0.515)	(0.555)
group-single(single)	-2.776***	-3.087***	-5.622***
	(0.767)	(0.901)	(1.383)
prev-payoff	0.002***		
	(0.001)		
avg-prev-payoff		0.013***	
		(0.004)	
avg-exp-prev-payoff			0.028***
			(0.008)
Questionnaire controls	Yes	Yes	Yes
Constant	0.453	0.306	-2.242***
	(0.403)	(0.401)	(0.811)
Observations	4415	4415	4415

Mixed-effects linear regressions. Random intercepts at the subject level. Standard errors in parentheses, clustered at the level of matching groups. Data from rounds 13-24. The dependent variable "conflict_{it}" is equal to 1 if individual i opted for conflict in round t, and is zero if i opted for the outside option. "prev-payoff" equals i's realized payoff in the last contest played. "avg-prev-payoff" equals i's average realized payoff in all previous contests played. "avg-exp-prev-payoff" equals i's average expected payoff (based on effort choices) in all previous contests played. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B.5 Conflict choices conditional on agreement costs

Table B4: Individual decision to opt for conflict: agreement costs

	(1) conflict$_{it}$	(2) conflict$_{it}$	(3) conflict$_{it}$	(4) conflict$_{it}$	(5) conflict$_{it}$
group-group		1.508*	2.464***	1.536*	3.377***
		(0.864)	(0.915)	(0.905)	(1.069)
group-choice	0.345	2.994***	0.462	3.035***	1.204
	(0.478)	(0.810)	(1.238)	(0.799)	(0.928)
group-single(group)	1.582***	4.155***	6.136***	4.484***	3.156***
	(0.521)	(0.790)	(1.304)	(0.931)	(0.882)
group-single(single)	-2.794***	-2.911***	-2.898***	-2.852***	-2.843***
	(0.770)	(0.893)	(0.891)	(0.865)	(0.863)
group-group(high-chat-time-4)	-1.779***				
	(0.536)				
group-group(low-chat-time-4)	-0.470				
	(0.717)				
avg-chat-time-12		-0.068***	-0.093***		
		(0.015)	(0.014)		
group-single(group)×avg-chat-time-12			-0.028		
			(0.030)		
group-choice×avg-chat-time-12			0.090***		
			(0.033)		
avg-chat-time-4				-0.057***	-0.096***
				(0.014)	(0.017)
group-single(group)×avg-chat-time-4					0.068***
					(0.021)
group-choice×avg-chat-time-4					0.079***
					(0.025)
Questionnaire controls	Yes	Yes	Yes	Yes	Yes
Constant	0.484	0.499	0.495	0.487	0.486
	(0.402)	(0.408)	(0.407)	(0.408)	(0.404)
Observations	4416	4176	4176	4140	4140

Mixed-effects logistic regressions. Random intercepts at the subject level. Standard errors in parentheses, clustered at the level of matching groups. Data from rounds 13-24. The dependent variable "conflict$_{it}$" is equal to 1 if individual i opted for conflict in round t. "group-group(high-chat-time-4)" ("group-group(low-chat-time-4)") is a dummy indicating if, in *group-group*, i's average seconds spent in the chat in rounds 1-4 is above (below) the median for all subjects in this treatment."avg-chat-time-12" equals i's average seconds spent in the chat in rounds 1-12. "avg-chat-time-4" equals i's average seconds spent in the chat in rounds 1-4. The number of observations decreases by 240 because the data on page times was accidentally deleted by the laboratory for one session of *group-single*. It decreases further in estimation (5) because some subjects did not enter a Tullock contest in rounds 1-4. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B.6 Individual estimates of their win probability in the conflict

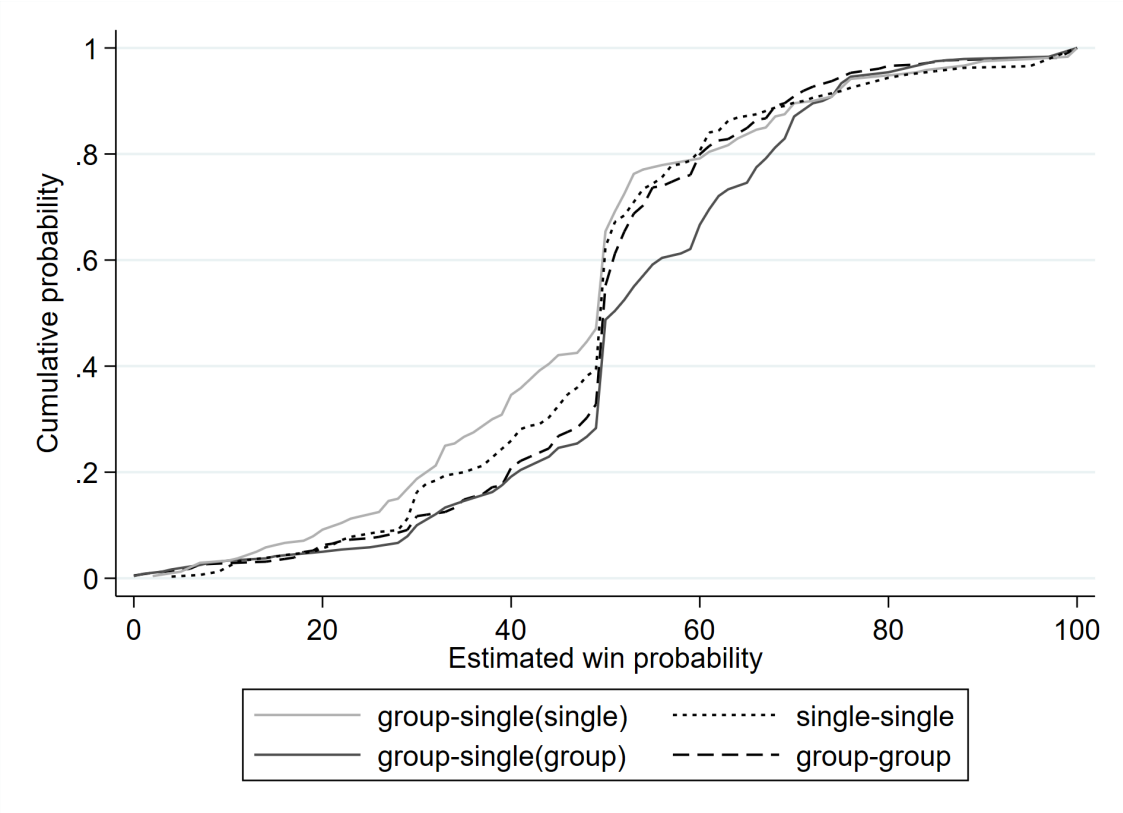

Figure B2: Cumulative distribution functions of the estimated win probabilities

B.7 Conflict choices conditional on perceived strength

Table B5: Individual decision to opt for conflict: perceived strength

	(1) conflict$_{it}$	(2) conflict$_{it}$	(3) conflict$_{it}$
group-group	-1.248*	-1.249*	-1.229*
	(0.648)	(0.655)	(0.635)
group-choice	0.294	0.283	0.229
	(0.478)	(0.488)	(0.483)
group-single(group)	1.398***	1.370**	1.367***
	(0.541)	(0.548)	(0.502)
group-single(single)	-2.577***	-2.635***	-2.812***
	(0.733)	(0.748)	(0.784)
winprob>50	1.791***		
	(0.360)		
winprob>average		1.684***	
		(0.330)	
overestimation>average			0.944***
			(0.336)
Questionnaire controls	Yes	Yes	Yes
Constant	-0.357	-0.266	0.127
	(0.383)	(0.388)	(0.407)
Observations	4416	4416	4416

Mixed-effects logistic regressions. Random intercepts at the subject level. Standard errors in parentheses, clustered at the level of matching groups. Data from rounds 13-24. The dependent variable "conflict$_{it}$" is equal to 1 if individual i opted for conflict in round t, and is zero if i opted for the outside option. "winprob>50" is a dummy variable that indicates whether i's average estimate of her win probability is above 50%. "winprob>average" is a dummy variable that indicates whether i's average estimate of her win probability is above the mean estimate of all subjects. "overestimation>average" is a dummy variable that indicates whether the difference between i's average estimate and her average realized win probability is above the mean of this difference for all subjects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B.8 Individual motivations for maintaining the group

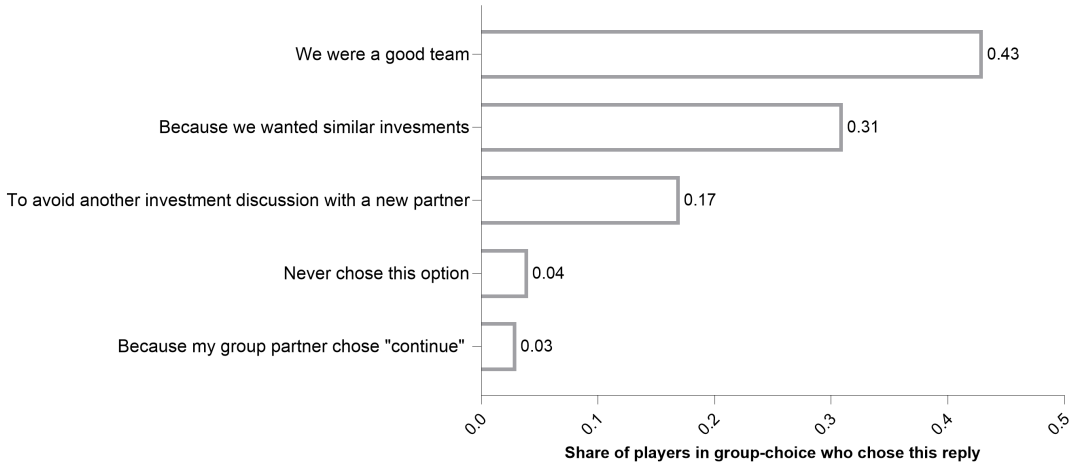

Figure B3: Post-experimental question in the treatment *group-choice*: "Why did you choose the option *stay together*?"

C Experimental instructions

Instructions for the *group-group* treatment[40]

Welcome and thank you for taking part in our experiment! Please read these instructions carefully and completely. Properly understanding them will help you to make better decisions and, hence, to earn more money. If you have any questions, please raise your hand and an experimenter will come to answer your question at your desk. During this experiment, please switch off your mobile phone and please do not communicate with any other participants unless the experiment specifically allows it. All information collected during this experiment will be treated confidentially and anonymously.

Your payoffs in this experiment will be measured in Tokens. At the end of the experiment, we will convert the Tokens you have earned to cash and we will pay you in private. For every 5 Tokens you earn you will be paid 1 RMB in cash. In addition to the Tokens earned during the experiment, each participant will receive a show-up-fee of 20 RMB.

The Game: Two groups (of two participants) decide whether they would like to compete for a prize. The game proceeds in up to two stages.

Stage 1:
Each participant must first individually decide whether to "continue" or to "quit" by choosing one of the two buttons on the computer screen.

- For each group, a joint group decision will be determined as follows: If both group members choose the same option (either to "continue" or to "quit"), then this decision becomes the group decision. If one member chooses to "continue" and the other one chooses to "quit", then a coin flip decides whose decision is taken to be the group decision.

If both groups' decision is "quit", then the game ends. Each player receives 52 tokens.

If both groups' decision is "continue", then they all enter stage 2.

If one group chooses "continue" and the other group chooses "quit", then a coin-flip picks one of two decisions randomly.

- If the outcome of the coin-flip is "quit", the game ends. Each player receives 52 tokens.
- If the outcome of the coin-flip is to "continue", then all four participants enter stage 2.

[40]The instructions for the other three experimental treatments follow exactly in line with the modifications described in Section 3.1.

Stage 2:
If stage 2 is reached, the two groups will compete for a prize of 400 Tokens.

Each group must first independently decide how many Tokens to invest in the competition. The investment must be a positive integer between 1 and 400, that is, 1, 2, 3, . . . , and so on, up to 400.

- Your group investment needs to be decided jointly with your group member. Half of the amount invested has to be paid by each group member (that is, will be subtracted from your earnings), whether or not you win the prize. Your group investment is determined as follows:
  - After entering stage 2, a chat window appears on the screen of you and your group member. You can chat with each other for a maximum of one minute to discuss your group investment. (The content of the chat is not restricted in any way, except that you are forbidden to reveal your identity, seat number or anything that might uncover your anonymity, or to make threats. If you violate these restrictions, you will be asked to leave the laboratory and will not be paid.)
  - During this one minute, you can choose to end the chat at any time as long as you think you have sufficiently discussed the group investment with your group member.
  - Once you ended the chat, you and your group member will be asked to choose an investment for the group.
  - If the two group members choose the same number of Tokens as group investment, this amount automatically constitutes the joint investment.
  - If the two group members choose different amounts of Tokens as the group investment, they will be given another 20 seconds to chat and make a new choice for the group investment after that. If these new decisions are still different, the group's investment will automatically be set to 1 Token.

The investment of the other group is determined by the same procedure.

Once both groups have chosen their respective investment, a fortune wheel will decide who wins the prize of 400 Tokens. The fortune wheel is divided into two colors: blue and green. Blue represents the number of Tokens invested by your group and green represents the number of Tokens invested by your opponent group. The fractions of the colors on the fortune wheel correspond exactly to the share of the respective investment in the total investments of the two groups. On top of the fortune wheel, there is an arrow pointing to the middle. The fortune wheel will start to rotate and then stop randomly. If the arrow is in the blue-colored area, your group wins the prize. If the arrow is in the green-colored area, your opponent group wins the prize.

This means that, for each group, the probability to win the prize of 400 Tokens is equal to

$$\text{Prob. group wins} = \frac{\text{Tokens from this group}}{\text{Tokens from this group} + \text{Tokens from the opponent group}}$$

Therefore, the probability of winning depends not only on your own investment but also on the investment of your opponent group. The more Tokens you spend, the more likely your group wins the prize. More Tokens invested, however, also means that more needs to be paid, irrespective of the outcome of the fortune wheel. While the group members share the investment equally, they also share the prize equally if they win.

To summarize: 1if you did not enter stage 2, your payoff is 52 tokens. (2) if you entered stage 2, your payoff is determined as follows:

- If your group wins, your payoff is: 0.5×400-0.5×your group's investment
- If your group loses, your payoff is: -0.5× your group's investment

The procedures:
The main part of the experiment consists of 24 rounds. In each round, the computer will randomly assign all players to groups of two and then randomly match one group with another group, to play the game described above.

At the end of the experiment, two of the 24 rounds will be randomly selected to calculate your payment. The sum of your payoffs from those two selected rounds will be converted into cash at the rate of 5 Tokens = 1 RMB. On top of this payment that depends on decisions made in those two rounds, you will also receive a fixed payment of 30 RMB for your participation in the experiment. Note that if your total payoff from the two selected rounds is negative, this loss will be deducted from your fixed payment.

Before the experiment starts, we will ask you to answer a few questions on your computer screen that should help clarify the rules of the game. After that you will be able to go through one test round of the competition about the prize to acquaint yourself with the rules of stage 2 of the game. In some rounds, when you choose between "continue" and "quit", we will additionally ask you to estimate the probability that your group will win the prize, should the game enter into stage 2. At the end of the experiment, we will ask you to answer short survey for data collection purpose. We will pay you 5 RMB for the estimations and the short survey you are required to answer. These answers and all your choices throughout the experiment will only be used in an anonymized way that does not allow to reveal your identity.

University of Innsbruck - Working Papers in Economics and Statistics
Recent Papers can be accessed on the following webpage:

https://www.uibk.ac.at/eeecon/wopec/

2023-16 **Changxia Ke, Florian Morath, Sophia Seelos:** Do groups fight more? Experimental evidence on conflict initiation

2023-15 **Loukas Balafoutas, Helena Fornwagner, Rudolf Kerschbamer, Matthias Sutter, and Maryna Tverdostup:** Serving consumers in an uncertain world: A credence goods experiment

2023-14 **Loukas Balafoutas, Helena Fornwagner, Rudolf Kerschbamer, Matthias Sutter, and Maryna Tverdostup:** Diagnostic Uncertainty and Insurance Coverage in Credence Goods Markets

2023-13 **Sarah Lynn Flecke, Rene Schwaiger, Jürgen Huber, Michael Kirchler:** Nature Experiences and Pro-Environmental Behavior: Evidence from a Randomized Controlled Trial

2023-12 **Christian König-Kersting and Stefan T. Trautmann:** Grit, Discounting, & Time Inconsistency

2023-11 **Stefano Piasenti, Marica Valente, Roel van Veldhuizen, Gregor Pfeifer:** Does Unfairness Hurt Women? The Effects of Losing Unfair Competitions

2023-10 **Pascal Kieren, Christian König-Kersting, Robert Schmidt, Stefan Trautmann, Franziska Heinicke:** First-Order and Higher-Order Inflation Expectations: Evidence about Households and Firms

2023-09 **Marica Valente, Timm Gries, Lorenzo Trapani:** Informal employment from migration shocks

2023-08 **Natalie Struwe, Esther Blanco, James M. Walker:** No response to changes in marginal incentives in one-shot public good experiments

2023-07 **Sebastian Bachler, Sarah Lynn Flecke, Jürgen Huber, Michael Kirchler, Rene Schwaiger:** Carbon Pricing, Carbon Dividends and Cooperation: Experimental Evidence

2023-06 **Elisabeth Gsottbauer, Michael Kirchler, and Christian König-Kersting:** Climate Crisis Attitudes among Financial Professionals and Climate Experts

2023-05 **Xiaogeng Xu, Satu Metsälampi, Michael Kirchler, Kaisa Kotakorpi, Peter Hans Matthews, Topi Miettinen:** Which income comparisons matter to people, and how? Evidence from a large field experiment

2023-04 **Tanja Hoertnagl, Rudolf Kerschbamer, Regine Oexl, Rudi Stracke, and Uwe Sunde:** Heterogeneity in Rent-Seeking Contests with Multiple Stages: Theory and Experimental Evidence

2023-03 **Melissa Newham, Marica Valente:** The Cost of Influence: How Gifts to Physicians Shape Prescriptions and Drug Costs

2023-02 **Natalie Struwe, Esther Blanco, James M. Walker:** Determinants of Financial Literacy and Behavioral Bias among Adolescents

2023-01 **Marco Aschenwald, Armando Holzknecht, Michael Kirchler, Michael Razen:** Determinants of Financial Literacy and Behavioral Bias among Adolescents

2022-20 **Silvia Angerer, Daniela Glätzle-Rützler, Philipp Lergetporer, and Thomas Rittmannsberger:** Beliefs about social norms and (the polarization of) COVID-19 vaccination readiness

2022-19 **Edward I. Altman, Marco Balzano, Alessandro Giannozzi, Stjepan Srhoj:** Revisiting SME default predictors: The Omega Score

2022-18 **Johannes Diederich, Raphael Epperson, Timo Goeschl:** How to Design the Ask? Funding Units vs. Giving Money

2022-17 **Toman Barsbai, Vojtěch Bartoš, Victoria Licuanan, Andreas Steinmayr, Erwin Tiongson, and Dean Yang:** Picture This: Social Distance and the Mistreatment of Migrant Workers

2022-16 **Andreas Steinmayr, Manuel Rossi:** Vaccine-skeptic physicians and COVID-19 vaccination rates

2022-15 **Stjepan Srhoj, Alex Coad, Janette Walde:** HGX: The Anatomy of High Growth Exporters

2022-14 **Martin Obradovits, Philipp Plaickner** Price-Directed Search, Product Differentiation and Competition

2022-13 **Utz Weitzel, Michael Kirchler** The Banker's Oath And Financial Advice

2022-12 **Julian Granna, Wolfgan Brunauer, Stefan Lang:** Proposing a global model to manage the bias-variance tradeoff in the context of hedonic house price models

2022-11 **Christoph Baumgartner, Stjepan Srhoj and Janette Walde:** Harmonization of product classifications: A consistent time series of economic trade activities

2022-10 **Katharina Momsen, Markus Ohndorf:** Seller Opportunism in Credence Good Markets ? The Role of Market Conditions

2022-09 **Christoph Huber, Michael Kirchler:** Experiments in Finance ? A Survey of Historical Trends

2022-08 **Tri Vi Dang, Xiaoxi Liu, Florian Morath:** Taxation, Information Acquisition, and Trade in Decentralized Markets: Theory and Test

2022-07 **Christoph Huber, Christian König-Kersting:** Experimenting with Financial Professionals

2022-06 **Martin Gächter, Martin Geiger, Elias Hasler:** On the structural determinants of growth-at-risk

2022-05 **Katharina Momsen, Sebastian O. Schneider:** Motivated Reasoning, Information Avoidance, and Default Bias

2022-04 **Silvia Angerer, Daniela Glätzle-Rützler, Philipp Lergetporer, Thomas Rittmannsberger:** How does the vaccine approval procedure affect COVID-19 vaccination intentions?

2022-03 **Robert Böhm, Cornelia Betsch, Yana Litovsky, Philipp Sprengholz, Noel Brewer, Gretchen Chapman, Julie Leask, George Loewenstein, Martha Scherzer, Cass R. Sunstein, Michael Kirchler:** Crowdsourcing interventions to promote uptake of COVID-19 booster vaccines

2022-02 **Matthias Stefan, Martin Holmén, Felix Holzmeister, Michael Kirchler, Erik Wengström:** You can't always get what you want–An experiment on finance professionals' decisions for others

2022-01 **Toman Barsbai, Andreas Steinmayr, Christoph Winter:** Immigrating into a Recession: Evidence from Family Migrants to the U.S.

2021-32 **Fanny Dellinger:** Housing Support Policies and Refugees' Labor Market Integration in Austria

2021-31 **Albert J. Menkveld, Anna Dreber, Felix Holzmeister, Jürgen Huber, Magnus Johannesson, Michael Kirchler, Sebastian Neusüss, Michael Razen, Utz Weitzel and et al:** Non-Standard Errors

2021-30 **Toman Barsbai, Victoria Licuanan, Andreas Steinmayr, Erwin Tiongson, Dean Yang:** Information and Immigrant Settlement

2021-29 **Natalie Struwe, Esther Blanco, James M. Walker:** Competition Among Public Good Providers for Donor Rewards

2021-28 **Stjepan Srhoj, Melko Dragojević:** Public procurement and supplier job creation: Insights from auctions

2021-27 **Rudolf Kerschbamer, Regine Oexl:** The effect of random shocks on reciprocal behavior in dynamic principal-agent settings

2021-26 **Glenn E. Dutcher, Regine Oexl, Dmitry Ryvkin, Tim Salmon:** Competitive versus cooperative incentives in team production with heterogeneous agents

2021-25 **Anita Gantner, Regine Oexl:** Respecting Entitlements in Legislative Bargaining - A Matter of Preference or Necessity?

2021-24 **Silvia Angerer, E. Glenn Dutcher, Daniela Glätzle-Rützler, Philipp Lergetporer, Matthias Sutter:** The formation of risk preferences throughsmall-scale events

2021-23 **Stjepan Srhoj, Dejan Kovač, Jacob N. Shapiro, Randall K. Filer:** The Impact of Delay: Evidence from Formal Out-of-Court Restructuring

2021-22 **Octavio Fernández-Amador, Joseph F. Francois, Doris A. Oberdabernig, Patrick Tomberger:** Energy footprints and the international trade network: A new dataset. Is the European Union doing it better?

2021-21 **Felix Holzmeister, Jürgen Huber, Michael Kirchler, Rene Schwaiger:** Nudging Debtors to Pay Their Debt: Two Randomized Controlled Trials

2021-20 **Daniel Müller, Elisabeth Gsottbauer:** Why Do People Demand Rent Control?

2021-19 **Alexandra Baier, Loukas Balafoutas, Tarek Jaber-Lopez:** Ostracism and Theft in Heterogeneous Groups

2021-18 **Zvonimir Bašić, Parampreet C. Bindra, Daniela Glätzle-Rützler, Angelo Romano, Matthias Sutter, Claudia Zoller:** The roots of cooperation

2021-17 **Silvia Angerer, Jana Bolvashenkova, Daniela Glätzle-Rützler, Philipp Lergetporer, Matthias Sutter:** Children's patience and school-track choices several years later: Linking experimental and field data

2021-16 **Daniel Gründler, Eric Mayer, Johann Scharler:** Monetary Policy Announcements, Information Schocks, and Exchange Rate Dynamics

2021-15 **Sebastian Bachler, Felix Holzmeister, Michael Razen, Matthias Stefan:** The Impact of Presentation Format and Choice Architecture on Portfolio Allocations: Experimental Evidence

2021-14 **Jeppe Christoffersen, Felix Holzmeister, Thomas Plenborg:** What is Risk to Managers?

2021-13 **Silvia Angerer, Daniela Glätzle-Rützler, Christian Waibel:** Trust in health care credence goods: Experimental evidence on framing andsubject pool effects

2021-12 **Rene Schwaiger, Laura Hueber:** Do MTurkers Exhibit Myopic Loss Aversion?

2021-11 **Felix Holzmeister, Christoph Huber, Stefan Palan:** A Critical Perspective on the Conceptualization of Risk in Behavioral and Experimental Finance

2021-10 **Michael Razen, Alexander Kupfer:** Can increased tax transparency curb corporate tax avoidance?

2021-09 **Changxia Ke, Florian Morath, Anthony Newell, Lionel Page:** Too big to prevail: The paradox of power in coalition formation

2021-08 **Marco Haan, Pim Heijnen, Martin Obradovits:** Competition with List Prices

2021-07 **Martin Dufwenberg, Olof Johansson-Stenman, Michael Kirchler, Florian Lindner, Rene Schwaiger:** Mean Markets or Kind Commerce?

2021-06 **Christoph Huber, Jürgen Huber, and Michael Kirchler:** Volatility Shocks and Investment Behavior

2021-05 **Max Breitenlechner, Georgios Georgiadis, Ben Schumann:** What goes around comes around: How large are spillbacks from US monetary policy?

2021-04 **Utz Weitzel, Michael Kirchler:** The Banker's Oath And Financial Advice

2021-03 **Martin Holmen, Felix Holzmeister, Michael Kirchler, Matthias Stefan, Erik Wengström:** Economic Preferences and Personality Traits Among Finance Professionals and the General Population

2021-02 **Christian König-Kersting:** On the Robustness of Social Norm Elicitation

2021-01 **Laura Hueber, Rene Schwaiger:** Debiasing Through Experience Sampling: The Case of Myopic Loss Aversion.

University of Innsbruck

Working Papers in Economics and Statistics

2023-16

Changxia Ke, Florian Morath, Sophia Seelos

Do groups fight more? Experimental evidence on conflict initiation

Abstract
This paper investigates whether distributional conflicts become more likely when groups are involved in the fight. We present results from a laboratory experiment in which two parties can appropriate resources via a contest or, alternatively, take an outside option. Keeping monetary gains expected from fighting constant across all treatments, the experiment compares conflict choices of players in two-against-two, one-against-one, and two-against-one settings. Overall, we find evidence for a higher propensity to opt for conflict when entering the fight in a group than when having to fight as a single player. The effects are strongest in endogenously maintained groups and in the presence of group size advantages (i.e., in two-against-one). The results can be explained by a stronger non-monetary utility from fighting in (endogenous) groups and coincide with a biased perception of the fighting strength in asymmetric conflict.

ISSN 1993-4378 (Print)
ISSN 1993-6885 (Online)