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Risky Tax Avoidance Decisions and Intra-Group Payoff Conflict

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Abstract

This paper investigates the dynamics of group decisions regarding risky tax avoidance strategies using a laboratory experiment. To identify the causes of risk taking by groups, we compare individual to group decisions in three scenarios. The first scenario allocates payoffs from group decisions equally to all members of a group. The second and third scenario introduce intra-group payoff conflict as a new influential factor in group dynamics. Hereby, we separate intra-group payoff conflicts in the distribution of costs and profits. This manipulation allows us to disentangle group discussion effects resulting from the competing theories of *polarization* and *diversification of opinions*. Our overall findings support a predominant *diversification of opinions effect*. When group members share all payoffs equally, this effect overcomes polarization in 100% of the cases where outstanding individuals are risk averse, while group polarization appears to be more likely towards outstanding risk loving subjects. Intra-group payoff conflict shifts these likelihoods, supporting the importance of rational arguments in group polarization. Consequently, our experimental results support a strong increase in the level of average tax avoidance following group decisions in case of all or negative outcomes being shared equally by group members. Intra-group payoff in the distribution of costs, however, removes this difference and shifts, both individual and group preferences, towards safety.

Keywords

Group, tax avoidance, risk, intra-group payoff conflict, polarization, diversification of opinions

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1. Introduction

Most choices in life demand us to decide together with others rather than alone. We are part of teams, families or groups of friends. While decision making in groups has long been studied in social psychology it has recently gained interest in economic research.[1] Especially in a business context, such as corporate tax planning, strategic decisions are likely to be taken by groups, e.g. the management board, a steering committee or a project team. The current project's aim is to provide further evidence on these group decisions. Hereby we focus on legal tax avoidance as an example of risky strategy choices by companies.

We specifically choose tax avoidance as our decision framing for the following reasons. Tax avoidance is legal as opposed to clearly illegal tax evasion behavior and thus does not represent cheating. Nevertheless, as the competent fiscal authorities might not accept strategies such as aggressive transfer pricing and the administrative costs of strategy revision can be significant, "grey area" tax planning is still risky. Accordingly, tax avoidance does represent decision making under risk. Last, risky tax avoidance strategies play a much bigger part in company's day-to-day business than illegal tax evasion and have recently gained strong political focus (OECD, 2013; Council of the European Union, 2016).

The assumption of group decision making with respect to tax strategies is supported by a recent survey approach into corporate tax planning in Germany (Feller and Schanz, 2017). Furthermore, aggressive tax planning often involves additional help from a set of intermediaries such as consultants, lawyers and accountants (Council of the European Union, 2018).

Besides its importance in practice, prior evidence regarding risk taking by groups as compared to individuals is not conclusive. Two characteristics of groups as decision makers have been discussed in order to explain the outcome of group decision processes, communication and shared (payoff) consequences. In order to broaden our understanding of group decision dynamics we specifically manipulate the latter to study the former. The main explanation given for deviations of group behavior is communication (see e.g. Shupp and Williams, 2008; Sheremeta and Zhang, 2010 or Bougheas et al., 2013). In addition, recent evidence also discusses shared payoff consequences as a driver of group decision outcomes (Sutter, 2009; Lohse and Simon, 2019). We argue that manipulating payoff consequences within groups does not only help to understand shared consequences as a decision factor but furthermore offers a novel chance to study group discussion and its underlying dynamics. Regarding the influence

[1] See Charness and Sutter (2012) for an overview of related results by the experimental economics literature.

of group discussion on decision making two theories have been proposed, 1) polarization and 2) the diversification of opinions. While polarization leads groups to deviate from average individual preferences towards the position of relatively extreme individuals, a diversification of opinions suggests that groups "average out" relatively outstanding individual preferences in an attempt to reach a compromise (also see Bär et al., 2011). While both effects are contrary to each other, a priori expectations on the direction of a potential shift in risk taking cannot be formed based on either one without making strong assumptions about the distribution of individual preferences. In our experimental design, we manipulate payoff consequences in a way that is expected to shift individual preferences towards either safety or high risk taking. These shifts provide the assumptions about the distribution of individual preferences needed in order to form a priori expectations regarding group outcomes based on both theories, polarization and diversification of opinions.

In our first treatment (*All for All*), we compare individual and group consensus decisions in a situation where all benefits and potential costs of tax avoidance are shared equally among all group members. In our second (third) treatment *One for All Cost* (*One for All Benefit*) one of the group members is randomly selected to be accountable for the tax avoidance strategy chosen by the group. This group member has to bear the accompanying costs of strategy failure (One for All Cost). In treatment One for All Benefit this group member gains the additional profits due to successful tax avoidance. The random allocation process of additional costs or benefits creates a relatively high loss in treatment One for All Cost and a relatively large gain in treatment One for All Benefit, both attached to rather small probabilities. Based on an overestimation bias of such small probability losses and gains (see Kahneman and Tversky, 1979), individual preferences are expected to shift towards safety in treatment One for All Cost, and towards high risk taking in treatment One for All Benefit respectively. Our predictions regarding the position of relatively extreme individual preferences are based on exactly these shifts. To verify the generalizability of our findings regarding tax avoidance behavior to general risk taking we repeat our experiment for a small number of subjects using a completely neutral risky investment framing. Overall generalizability and detailed results of the comparison are presented and discussed under robustness.

Results of our experimental analysis support strong differences between individual and group decision outcomes. In line with prior evidence regarding comparisons between individual and group risk taking based on archival data (Bär et al., 2011; Adams and Ferreira, 2010), we provide experimental evidence supporting a *diversification of opinions effect* to be the major driver of group decision making. While this tendency towards compromise is stronger than

polarizations towards relatively extreme individuals, polarization is nevertheless present in group decision making. In a situation where all payoffs are shared among all group members polarization towards relatively risk taking individuals is a lot stronger than polarization towards risk averse group members. The introduction of intra-group payoff conflict changes the relative strength of polarization overall and into specific directions, while nevertheless the higher importance of compromise prevails. In line with these effects, our results regarding the overall level of tax avoidance are the following. Risky tax avoidance increases significantly following group decisions. However, this increase in risk taking by groups is primarily driven by the sharing of costs among group members and vanishes in case of a random allocation of costs to one group member. Creating inequality in the distribution of profits among group members further increases the level of tax avoidance. A result that contradicts strong preferences for equality in payoff allocations. All of our main results hold under a neutral investment framing.

We pioneer in studying intra-group conflicts that are characterized by payoff differences between the individuals in one group. A question that so far has been neglected by empirical research (also see Charness and Sutter, 2012). By exploiting shifts in individual preferences due to our treatments, we contribute to the comprehension of group dynamics in decision-making. In addition, we are the first to study group consensus decisions with respect to risky tax avoidance. Via a direct comparison of tax avoidance and risky investment decisions, we contribute to the understanding of tax aggressiveness within legal boundaries.

The remainder of this paper is organized as follows. In section 2, the related literature and its implications for the current study are briefly presented. In section 3, we derive the hypothesis and describe the experimental design. Results from the empirical analysis are stated and discussed in section 4. Section 5 closes with final remarks.

2. Literature Review

The framing: tax avoidance

To study risk taking by groups in a business context we chose to frame our experiment as a tax avoidance decision that has to be made by a board of directors. Tax avoidance as opposed to tax evasion is per definition legal and as such not considered cheating. Nevertheless, tax avoidance is risky, as tax authorities might not accept chosen strategies (e.g. a suggested transfer price for intracompany multinational trading). Tax evasion on the other hand is usually not regarded as mere risk taking behavior (Baldry, 1986; Mittone, 2006; Trivedi and Chung, 2006). Differences found are commonly attributed to social norms and moral obligations attached to cheating for tax purposes, while not being present under neutral or gambling terms

(Baldry, 1986, Mittone, 2006, Wartick et al., 1999). Abbink and Hennig-Schmidt (2006) doubt whether it is possible at all to induce moral sentiments in lab experiments. Our experiment avoids this potential problem as we chose a tax framing where all tax strategies offered are presented to the participants as clearly legal and thus focus on the risk domain of tax strategies. Still, to make sure our results are not altered due to our chosen framing, we repeat our experiment for a small group of subjects employing a completely neutral investment framing.

Combining the literature on risk taking and cheating, two prior papers have studied tax evasion decisions by teams as compared to individuals (Lohse and Simon, 2019; Fochmann et al., 2019). Results by Lohse and Simon (2019) as well as Fochmann et al. (2019) provide evidence of a significant increase in tax evasion following team as compared to individual decisions. Lohse and Simon (2019) further differentiate between the effects of communication and shared payoffs within a pair of subjects. They conclude that the increase in tax evasion by teams is driven by the characteristic of joint liability rather than mere coordination on reports via the exchange of information. In our experimental design, we further distinguish joint liability in the profit and cost dimension. If team behavior is indeed driven by bearing potential outcomes together, we expect group behavior to change when either costs or benefits are attributed to only one group member.

Comparison of group and individual preferences in risky investments

By investigating group tax-avoidance-decisions, we are contributing to a growing body of research that studies differences in risk preferences when comparing group and individual decisions with monetary consequences. Three types of study designs can be distinguished:

1) Laboratory experiments employing a between subjects design with respect to groups and individuals both deciding on an investment task

2) Laboratory experiments employing a within subjects design with respect to individuals and groups both deciding on the lottery choice task designed by Holt and Laury (2002)

3) Field studies regarding historical betting data or behavior by mutual fund managers.

Regarding the overall conclusions drawn, prior results of these three types of studies cover the whole spectrum of possible shifts in risk preferences. The first group of studies commonly rely on the instructions used by Sutter (2007, 2009) and find higher risk seeking by groups (Sutter, 2007; Sutter, 2009; Bougheas et al., 2013; Nieboer, 2015). While conclusions drawn by the second group of studies tend to be more diverse. These studies provide evidence of groups acting closer to risk neutrality (Zhang and Casari, 2012) or expressing higher risk aversion

(Masclet et al., 2009; Sheremeta and Zhang, 2010). Some of these studies conclude that individual and group decisions only differ regarding extreme choices (Baker et al., 2008; Shupp and Williams, 2008). Field studies at last commonly find groups to take less extreme decisions and by doing so to take less risks on average (Bliss et al., 2008; Adams and Ferreira, 2010; Bär et al., 2011).

Throughout the literature two aspects have been discussed that commonly define groups as decision makers, 1) communication in order to reach a decision, and 2) group membership, often contrasted towards an "outgroup". When discussing the reasons for differences in risk taking between groups and individuals strong focus has been put on the first aspect, communication (see e.g. Shupp and Williams, 2008; Sheremeta and Zhang, 2010 or Bougheas et al., 2013). Charness et al. (2007b) show that the second aspect, group membership can be made salient through payoff commonality within groups, but also other features such as feedback about or observation of decisions taken by other group members, when an "outgroup" is present. In situations that do not involve the presence of an "outgroup", such as many (experimental) investment tasks, again common consequences, especially payoff commonality within groups has been found to induce salient group membership (see Sutter, 2009). In order to differentiate the effects of communication and shared consequences a common approach in the literature was to separate them into communication without a common decision or common consequences (mere coordination) and decisions found in isolation that do affect the payoffs of other group members (payoff communality without communication) (Sutter, 2009; Lohse and Simon, 2019). Our approach is different in the sense that we keep the aspect of communication and common decision making while introducing payoff conflicts within the group. We argue that this violation of the second characteristic of groups as decision makers offers a unique opportunity to study the first.

Communication in group decision making

When differences in risk taking by groups as compared to individuals have first been studied by social psychological research, shifts towards higher and lower risk have soon been considered part of a more general phenomenon – group *polarization* (Myers and Lamm, 1976). Several reasons have been discussed to be the source of group polarization.[2] First, social comparison may lead to polarization, as group members attempt to comply with what they think is socially correct in order to be perceived well by others (Festinger, 1954; Bär et al., 2011). Second, group identification may lead to the attempt to distance the own group from an

[2] For an overview also see Brown, 2000 and Bär et al., 2011.

"outgroup" (Hogg et al, 1990). Last, one of the major theoretical explanations for group polarization is persuasive argumentation.[3] The first two explanations, although potentially strengthened by communication among group members, can occur independent of the actual exchange of information. Persuasive argumentation however directly targets communication among group members and is independent of the existence on an "outgroup". In the following, we are therefore going to concentrate on this last explanation.[4] Persuasive argumentation emphasizes the importance of discussion among group members in order to induce shifts in preferences when comparing individual to group decisions (Burnstein and Vinokur, 1973). If the group discussion introduces valid and novel arguments to individual group members, those individuals will shift their position (Vinokur and Burnstein, 1978). Hereby, individuals who have all or most persuasive arguments at hand take confident decisions at the extreme ends of the available decision interval prior to any group discussion (Burnstein and Vinokur, 1973). In line with this general observation, early research has shown that both high-risk takers as well as very cautious individuals can be perceived to be very persuasive (see Clark, 1974). However, as polarization is merely a tendency towards extreme individual positions, it is strongly dependent upon the distribution of individual preferences prior to group decision-making. Therefore, it is usually not possible to form a priori expectations regarding the direction of induced shifts in risk taking due to polarization within groups.

While polarization is expected to shift groups towards the extreme ends of a decision continuum, a competing theory the *diversification of opinions* in group decision making is expected to have an opposing effect. The diversification of opinions theory, first introduced by Sah and Stiglitz (1986, 1991) in their model of hierarchies, describes the idea that group decisions represent a compromise among individual opinions. As individuals need to reach a conclusion when deciding together, the majority or average opinion among group members likely drives the final compromise. Accordingly, individuals with extreme prior positions have to change their position in order to reach a group decision. In the end, this effect of "averaging out" extreme individual positions in the attempt to compromise will lead to more moderate decisions overall (also see Adams and Ferreira, 2010; Bär et al., 2011). Field evidence regarding differences in risk taking by individuals and groups supports the presence of a diversification of opinions effect that reflects lower average risk taking by groups (Adams and Ferreira, 2010; Bär et al., 2011). However, it is important to note that this result regarding the level of risk taking is driven by the moderation of extreme risk lovers in a field of what is in general thought

[3] For a Meta-analysis on persuasive argumentation, see Isenberg (1986).
[4] Please note that all potential reasons for group polarization would lead to similar expectations.

of as a risk averse population. When making predictions about tendencies of group risk taking in general, caution should be applied, as the moderation of extreme positions just like the tendency to shift towards such extreme positions is highly dependent on the underlying distribution of individual preferences.

In conclusion, any explanation building upon a *polarization* or a *diversification of opinions* in group decision making is dependent on the distribution of individual preferences. Therefore, reasonable and reliable assumptions about this distribution are needed to form a priori expectations. In order to overcome this problem, we will exploit the hypothesized shifts in individual preferences in treatments One for All Cost and One for All Benefit, that are explained within the next paragraph, to form clear expectations regarding the outcome of the group decision process. This offers the unique opportunity to study the relative strength of diversification of opinions and polarization effects in a situation where they point in opposite directions.

Intra-group payoff conflict: Risk perception

Shifts in individual preferences in treatments One for All Cost and One for All Benefit are primarily expected due to the treatment dependent variations of individual payoffs and the attached probabilities. While the overall expected payoff is identical on both the group as well as the individual level across treatments, the range of possible individual payoffs and respective probabilities differs. When additional costs (profits) are randomly assigned to one of the group members, the probability of being paid an extremely low (high) amount with a relatively low probability attached to this outcome is introduced into the decision problem. Prior evidence shows that individuals tend to overestimate such low probabilities. This overestimation of the risk of negative consequences usually leads to a reduction in risk taking and results in a certainty effect. Quite on the contrary, facing a low probability profit leads a majority of individuals to bet on this high potential gain rather than the more probable one and as a result, to take higher risks (Allais, 1953, Kahneman and Tversky, 1979).

Additionally, prior research in social cognition has found individual risk assessments to suffer from both optimism bias, where the possibility of experiencing good events oneself as compared to others is considerably overestimated (Weinstein, 1980), and pessimism bias, the overestimation of the likelihood of negative results happening to oneself (Higgins, 1987). One potential venue through which these biases occur is focalism, leading individuals to be more concerned about themselves rather than others (Windschitl et al., 2003). A focus on potential own outcomes would again lead to an overestimation of both the risk of having to take over the

costs of tax avoidance as well as the chance of taking home additional profits in our intra-group payoff conflict scenarios. Accordingly, biases in risk taking resulting from overestimation effects regarding low probability payoffs are expected to alter decisions in treatments *One for All Cost* and *One for All Benefit* considerably.

We use these particular shifts on the individual level to form clear a priori expectations regarding the distribution of individual preferences across the risk continuum. These prior expectations are necessary to differentiate effects of *polarization* as opposed to a *diversification of opinions* in group decision making.

Intra-group payoff conflict: Fairness perception

Besides shifting individual preferences due to changes in the risk (chance) perception, intra-group payoff inevitably introduces a second variation into the decision problem. As the commonality of consequences within groups is no longer given, inequality is created among group members. This inequality violates a general principle of justice and is therefore likely to result in fairness concerns. Prior research regarding the allocation of resources among individuals has established three norms of justice in order to achieve fair allocations: distribution, procedure and retribution (Wenzel, 2003). Inequality of the outcome among comparable individuals constitutes a violation of distributive justice. Accordingly, we expect intra-group payoff conflicts to be perceived as unfair. Negative reactions towards unfairness and the tendency to restore equality alter decisions in a variety of contexts.[5] Such inequality aversion has been reported in both individual as well as group decision making (see e.g. He and Villeval, 2017). A tendency to restore equality in order to avoid unfair outcomes would lead to less risk taking in our experimental treatments One for All Cost and One for All Benefit. However, as individual decisions in our setting do not lead to payoff consequences for other participants, we expect inequality to affect group decisions primarily.

3. Hypothesis Development and Experimental Protocol

3.1. Hypothesis Development

During the experiment, each subject had to make two decisions per treatment, one individual and one group decision. The individual decisions had to be made prior to entering the group discussion. The instructions for the individual decision asked the participants to choose the tax avoidance strategy they prefer individually. The individual decision was private and it only

[5] Adams (1963, 1965) first discussed the idea of equality restoring responses to valuations of distributive justice in an economic context. For an overview of more recent research regarding behavior based on fairness preferences in e.g. ultimatum games, public good games and labor markets see Fehr et al. (2009).

affected the participant's own potential payoff. The decision outcome of the first decision in each treatment, the individual decision, is therefore used to analyze the distribution of individual preferences in each treatment. When all individuals in one group had stated their individual preferences, subjects were grouped together in teams of three. They were given the possibility to discuss strategies in order to reach a unanimity decision about the level of tax avoidance they want to choose together. This joint decision now affected the potential payoffs of all subjects in one group with each subject getting a specific (equal or *un*equal) share of the resulting profit. However, to ensure that the marginal incentives did not differ between the two decisions in each treatment, the potential individual payoffs did not differ between individual and group decisions.[6] Shifts in the distribution of individual risk preferences due to the introduction of intra-group payoff conflict are the basis for our study of the opposing effects of polarization and diversification of opinions in group decision making. Hence, we start by comparing the individual decision outcome, given by the level of individual tax avoidance, between treatments.[7]

Treatment differences: Individual decision outcome

Regarding differences in individual decisions, we expect a strong effect of distortions in risk (chance) perception following the introduction of intra-group payoff conflict. The fairness perception of the given payoff scheme on the other hand is expected to be of minor importance as individual decisions only affect individual payoffs. Individual decisions are also unaffected by group interaction, as individual decisions had to be made prior to group discussions in each treatment.[8] Accordingly, shifts in individual preferences in the presence of intra-group payoff conflict occur due to changes in the perception of the personal payoff range. When all consequences, costs as well as benefits, are shared equally by all group members the variance in individual payoffs is lower as compared to situations of intra-group payoff conflict. The random allocation of the costs of a failed tax avoidance strategy introduces relatively low payoffs connected to small probabilities into the individual payoff matrix. Based on the well-known effect of overestimation of small probabilities connected to extreme payoffs (Allais, 1953, Kahneman and Tversky, 1979), we expect individuals to shift their preferences towards safety in order to avoid these low payoff possibilities. Focalism in the form of a pessimism bias

6 In all treatments, the potential group payoff was equal to the sum of the three individual payoff shares. In other words, when deciding alone and in private (individual decision) the subject could receive only a specific share of the group's payoff, with the other two shares not being paid out to anyone. An overview of the potential payoffs in each treatment is given in Table 1 and in more detail in appendix II.

7 For further details on the experimental design, please refer to Figure 1 and 2.

8 Potential distortions due to the applied within subject's design and occurring order effects are discussed in terms of the robustness of results in section 4.3.

likely strengthens this effect. Accordingly, we expect individual tax avoidance to decrease in the presence of a random cost allocation as compared to situations of shared consequences. With respect to individual preferences regarding intra-group payoff conflict in the distribution of profits, prior evidence suggests that subjects tend to focus on the higher potential profit when choosing between lotteries with relatively large but unlikely gains. In addition, the chance of additional profits being attributed to oneself is likely overestimated due to an optimism bias (see section 2). As both effects support higher risk taking, we expect tax avoidance to increase when additional profits due to successful tax avoidance are randomly attributed to one subject as compared to equally sharing these profits. As shifts in the distribution of individual preferences due to intra-group payoff conflicts in the cost and profit domain point in opposite directions, we consequently expect the highest level of individual tax avoidance when additional profits are randomly assigned to one group member. Hypothesis 1.1 and 1.2 therefore state:

Hypothesis 1.1: Intra-group payoff conflict in the distribution of costs decreases the level of individual tax avoidance compared to an equal cost distribution.

Hypothesis 1.2: Intra-group payoff conflict in the distribution of profits increases the level of individual tax avoidance compared to an equal profit distribution.

Individual and group tax avoidance within treatments

In order to relate our results to prior research regarding risk preferences following group decisions, we start by comparing individual and group decision outcomes when all payoffs are shared equally among the differing members of a group. Prior evidence on risk taking by groups is inconclusive regarding the overall results and thus seems little help in forming expectations regarding our setting. However, we argue that a closer consideration of commonly applied experimental settings, and especially the probability range, changes this picture. As the second group of studies, laboratory experiments employing the Holt and Laury (2002) lottery choice task in a within subjects design between individual and group decisions, is closest to our experimental setup and yields most differing results, we consider results by these studies first. While coming to overall differing conclusions, results from this group of studies have one finding in common, groups are more or at least equally likely as individuals to choose the risky lottery with high winning probabilities. While the exact probabilities vary between studies, this effect commonly occurs across all studies regarding a winning probability of the risky lottery of 70 to 80 percent (Masclet et al., 2009; Shupp and Williams, 2008; Baker et al., 2008;

Sheremeta and Zhang, 2010; Zhang and Casari, 2012).[9] Given this common result and the acceptance probabilities of 80% for moderate tax avoidance and 60% for high tax avoidance in our experimental design, we would expect higher tax avoidance by groups than by individuals when all group members share all consequences equally.

Regarding results from the first group of studies, the winning probability of the given investment task is not varied and is kept constant at 66.66%. While this probability is slightly below the 70 to 80% mark where results of the second group of studies agree with each other, these studies still all conclude that groups take higher risks, which again is in line with our prior expectation regarding group risk taking under equal payoff distribution.

On the contrary, evidence from the third group of prior evidence, field studies, contradicts our expectations. Adams and Ferreira (2010), Bliss et al. (2008) and Bär et al. (2011) observe lower risk taking by groups of decision makers in the field. However, given the importance of the winning probability of lotteries found in laboratory experiments, this result is likely driven by deviations in that regard. In addition, other mechanism such as information gathering or the ability to diversify investments complicate comparisons between settings.

Following the argumentation by Adams and Ferreira (2010) and Bär et al. (2011), groups take lower risks than individuals due to a diversification of opinions effect. At this point, it is interesting to notice that throughout all experimental studies, higher risk taking by groups as compared to individuals always occurs in situations where a majority of individuals prefers risky lotteries or investments.[10] A result that also supports a diversification of opinions effect when consequences are shared equally among group members. However, as forming a priori expectations based on polarization or diversification of opinions in group decision making is always dependent upon the distribution of individual results, we cannot base our expectations on one or the other. We therefore base our expectations on the importance of the winning probability based on prior experimental evidence as stated above. This importance is further supported by conclusions of Baker et al. (2008) who find a significant interaction between individual and group decision making and the winning probability of a given lottery. Accordingly, based on results regarding high probability lotteries, we expect the level of tax

[9] Some studies report the mentioned effect for significantly lower winning probabilities of around 60% (Baker et al., 2008; Sheremeta, and Zhang, 2010) or even 35% (Zhang, and Casari, 2012).

[10] This is given in all studies subsumed in group two. Regarding studies in group one, e.g. Sutter (2007) reports that a clear majority (82% in the short term and 90% in the long term investment) of individuals invests some positive amount into the given lottery.

avoidance to increase following group decisions when all payoffs are shared equally among group members. H 2.1 thus states:

H 2.1: In the absence of intra-group payoff conflict group decision making increases the level of tax avoidance.

The expected shifts in individual risk preferences (H 1.1 and H 1.2) form the basis for our hypothesized group decision outcomes following the introduction of intra-group payoff conflict, based on the competing theories of *polarization* and *diversification of opinions*. If costs of a risky strategy are randomly attributed to one individual in the group, as stated above, individual preferences are expected to shift towards safety due to a biased risk perception. This shift creates a situation where extreme individuals are clearly positioned in the higher risk range of the decision spectrum. Given this as the starting point for group discussion, communication within the group, can lead to higher risk taking by groups if communication leads to a polarization effect towards extreme individual positions. In fact, prior evidence on the separate role of communication supports its ability to induce (additional) shifts towards higher risk taking even in the absence of group decision taking and shared consequences (Sutter, 2009, Lohse and Simon, 2019). The effect of polarization towards higher risk taking due to persuasive argumentation when facing a conflict in the distribution of costs is likely strengthened by the underlying objective probabilities of achieving a low outcome. In our experimental design, the objective probability of getting a comparatively low payoff is significantly reduced via the intra-group allocation of costs to one subject. This rational argument is likely to be strengthened in the group discussion, as groups are commonly found to be better at gathering and processing information (Bliss et al., 2008) and respond stronger to rational and tangible information (Adams and Ferreira, 2010). Therefore based on *polarization* in group decision making we expect tax avoidance to be higher following group decisions facing intra-group payoff conflicts in the distribution of costs. Hypothesis 2.2a therefore states:

H 2.2a: Polarization increases the level of tax avoidance following group decisions as compared to individual decision making when groups face an intra-group payoff conflict in the distribution of costs.

On the contrary, if extreme positions taken individually are moderated in the group discussion in order to reach a compromise, we expect tax avoidance to decrease following group decisions in the presence of intra-group payoff conflicts in the distribution of costs. This *diversification of opinions* effect is likely strengthened by fairness concerns within groups as the random allocation of costs resulting from risky strategies violates the principle of equality of outcome.

Based on a diversification of opinions in group discussion, we formulate the competing hypothesis 2.2b:

H 2.2b: The diversification of opinions decreases the level of tax avoidance following group decisions as compared to individual decision making when groups face an intra-group payoff conflict in the distribution of costs.

Regarding the effects of group decision making when profits are distributed unequally, polarization and diversification of opinions again point towards opposite directions. Given the expected shift of individual preferences towards higher risk taking due to perceptional biases, extreme individuals are now positioned at the safe end of the decision spectrum. Accordingly, *polarization* towards extreme positions would now lead to a decrease in tax avoidance following group decisions. As opposed to intra-group payoff conflicts in the distribution of costs, fairness concerns are now likely to reinforce polarization. The random allocation of additional profits due to risky tax avoidance violates the principle of distributional justice. If participants want to restore outcome equality among group members, a tendency towards safety will result. Again, fairness concerns are expected to be more pronounced in group decision making. Accordingly, fairness concerns support lower risk taking by groups as compared to individuals. Based on *polarization* following group decision making, hypothesis 2.3a states:

H 2.3a: Polarization decreases the level of tax avoidance following group decisions as compared to individual decision making when groups face an intra-group payoff conflict in the distribution of profits.

On the contrary, as extreme individuals are now expected to be positioned at the safe end of the decision range, the diversification of opinions in group decision making would result in higher risk taking by groups as compared to individuals. If extreme individual positions are moderated in order to reach a compromise in the group discussion, tax avoidance following group decisions is expected to increase. Based on the *diversification of opinions* in group discussion, hypothesis 2.3b states:

H 2.3b: The diversification of opinions increases the level of tax avoidance following group decisions as compared to individual decision making when groups face an intra-group payoff conflict in the distribution of profits.

Treatment differences: Group decision outcome

Given our expectations regarding the adaption of individual into group preferences, a comparison of group outcomes between treatments strongly depends on the relative strength of

polarization and diversification of opinions following the introduction of intra-group payoff conflicts. If *polarization* is the major factor in group decision making the expected shifts regarding the majority of individual preferences towards higher or lower tax avoidance are balanced out following the group decision. The underlying reasoning is that polarization would drive tax avoidance behavior back towards the resulting extreme positions and thus reverse the shifts in individual preferences. According to polarization, we would thus expect the difference in tax avoidance between equal distributions of payoffs and intra-group payoff conflicts following group decisions to be smaller than the difference in individual decision outcome. If polarization towards high risk and low risk extremes is equally strong, polarization in group discussion will even levy tax avoidance across payoff scenarios. However, we cannot assess the exact strength of polarization effects in the different payoff scenarios.

Again quite to the contrary, if a *diversification of opinions* effect is the major driver of group decision outcomes, we expect the gap between individual preferences across treatments to widen following group decision making. The underlying reasoning is that the attempt to reach a compromise would moderate high risk taking in the presence of intra-group payoff conflicts in the distribution of costs. This moderation would result in less risky group choices. The same attempt, however, would moderate safe choices in presence of intra-group payoff conflicts in the distribution of profits. This moderation would result in higher risk taking by groups. Accordingly, based on the *diversification of opinions effect*, we expect group tax avoidance to be highest in the presence of inequality in profit distribution, followed by equal payoff allocations, and lowest in the presence of inequality in the distribution of costs. Combining the impact of polarization and diversification of opinions, Hypothesis 3 therefore states:

H 3: The difference in tax avoidance due to intra-group payoff conflict is smaller following group as compared to individual decisions if the effect of polarization is stronger than that of a diversification of opinions and vice versa.

Further Analysis

In order to investigate the opposing effects of polarization and diversification of opinions in more detail, we study several aspects of the adaption mechanism in group discussion in a further analysis. Hereby we focus on a) studying those groups that experience conflicts regarding their initial individual position and b) analyzing the course and content of group discussions based on the group chat protocols collected during the experiment. The separate analysis of groups that experience conflict helps to understand what mechanism drives the final group outcome and can shed further light on the relative strength of effects (also see Zhang and Casari, 2012).

Further, both effects polarization and a diversification of opinions are most likely to be strong when individuals disagree to begin with (also see Bär et al., 2011). We define group conflict as a situation where the three individuals forming a group later choose different strategies in their individual decision. The accompanying evaluation of chat protocols allows us to analyze the importance of argumentation within groups. This analysis is of special importance regarding the suggested effects of polarization from a theoretical perspective. As polarization occurs due to persuasive argumentation, we are going to analyze the content and quantity of this argumentation.

3.2. Experimental Design

Across all treatments, we frame our experimental decision problem as the tax strategy choice of a company. The tax strategy choice specifically concerns the level of tax avoidance. Subjects are instructed to take the position of a board member of a multinational company. As such, they are asked to make strategic decisions that directly affect their company's profit and therewith their personal payoffs. A within subject approach is used for both comparisons between individual and group consensus decisions as well as treatment differences between the three possible payoff distributions. To control for order effects, the three tax avoidance treatments are presented in differing orders. Each subject has to make two decisions per treatment, one individual and one group decision. In the individual decision, subjects had to choose their personally preferred strategy before entering the group interaction. In the group decision, three subjects had to agree upon a unanimous choice. In the end, one of the six decisions is randomly selected for payoff. Due to the random mechanism, incentive compatibility is established for all choices. We include comprehension questions in order to ensure that subjects understand of the information provided. The experiment begins and ends with a questionnaire. An overview of the experimental sequence is provided in Figure 1. [11]

[11] Translations of the experimental instructions regarding the main part of the experiment are included in appendix VIII.

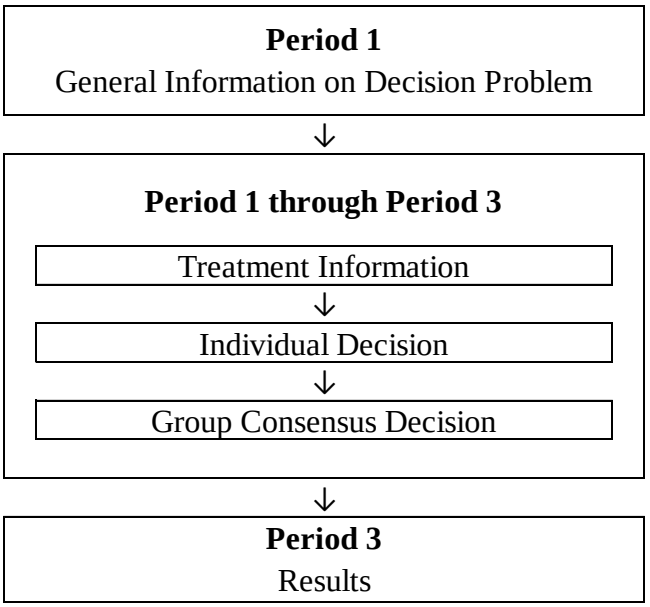

Figure 1. Experimental procedure

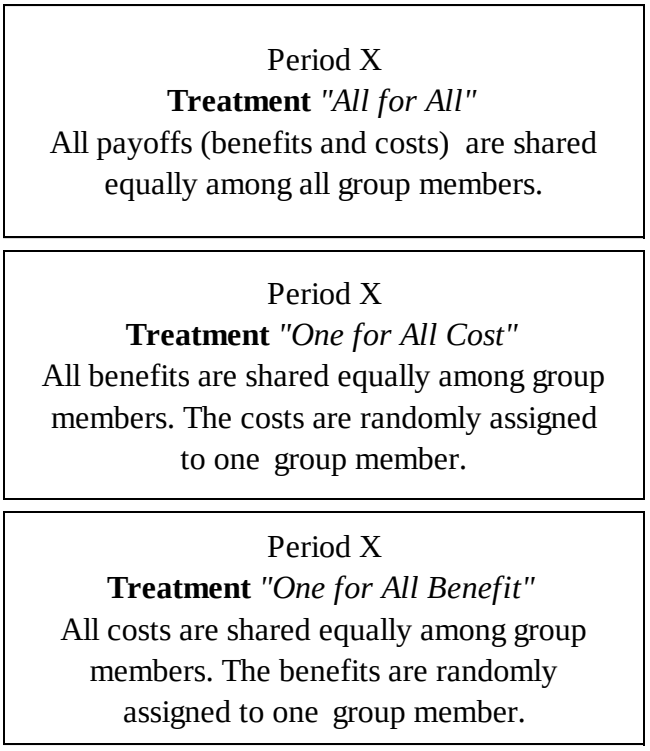

Figure 2. Experimental treatments

The experiment has been programmed and conducted with the experiment software z-Tree (Fischbacher, 2007). All instructions are given on screen, except for the information on the general decision factors that are provided on paper to keep them available throughout all experimental periods. These decision factors are identical across all treatments and include the overall pre-tax profits on the company and group level, the available strategy choices and the corresponding acceptance or rejection probabilities.

Figure 2 provides an overview of our experimental treatments. Treatment All for All represents our baseline treatment where all payoffs are shared equally among all group members. Treatment One for All Costs and One for All Benefit create intra-group payoff conflict in the distribution of costs and benefits respectively. The treatment specific remuneration system according to the allocation of costs and benefits of tax avoidance within the group was illustrated in detail on screen in the respective period.[12] Given all relevant information, participants first had to make an individual choice for one of the available tax avoidance strategies. The individual choice represents a standalone choice by the individual. It can never be payoff relevant for other group members. Following common procedures (e.g. Sutter, 2007, Bougheas et al., 2013, Sheremeta and Zhang, 2010) the marginal incentives in the individual decision are equal to those in the following group setting.

After the selection of their individually preferred strategy, participants entered the group decision process. Each group consisted of three individuals forming the executive board of a company. Regarding the influence of personal characteristics in group formation, Niboer (2015) concludes that gender composition is the only significant influential factor on outcome in risk taking by groups as compared to individuals. In order to avoid a deterring gender effect on our results, we control for a mixed structure of gender compositions in the random group allocation.

Each group got the opportunity to communicate with each other for a maximum of seven minutes via the chat function in z-Tree. During this time, groups could discuss freely. As many real-world decisions do not follow an externally imposed decision rule, the groups could come up with their own way of reaching a consensus decision during that time (also see Ambrus et al., 2015). However, in the end each group could only choose one strategy to implement for their hypothetical company in a given period. If subjects of one group selected different strategies in the group decision, they were granted an additional minute of chat time in order to reach an agreement. If no agreement was reached, the median of the selected strategies would determine the group choice. In fact, none of the groups in our experiment failed to reach an agreement so the median rule was never applied. Following prior research, groups remained unchanged throughout all experimental periods (see e.g. Masclet et al., 2009; Zhang and Casari, 2012; Nieboer, 2015). To avoid deterring effects of prior periods, results regarding all decisions made during the experiment were presented to the subjects at the end of the last (third) period.

[12] An overview of tax avoidance strategies and payoff taxonomy is presented in Table 1 in the next section; the resulting individual payoffs by treatment are included in appendix II.

3.3. Tax Avoidance Measurement

Participants were asked to choose between three distinct tax avoidance strategies. All strategies are defined by their level of potential tax savings (benefits), the probability of strategy success and the amount of additional administrative costs resulting from strategy failure. An overview of the tax avoidance strategies and the resulting payoffs is presented in Table 1. Whether a strategy is successful or not depends on its acceptance or rejection by the competent experimental tax authorities. Hereby both, the probability of a strategy being rejected and the additional costs incurred, are increasing in the level of potential tax savings. In order to replicate a realistic incentive for tax avoidance, strategies offering potential tax savings lead to higher expected corporate profits. However, as the inherent risk of rejection is increasing in the level of tax avoidance, expected net profits are not. In conclusion, the expected corporate profit of strategies 2 and 3, the tax avoidance strategies, is equally high but higher than the expected corporate profit of strategy 1, no tax avoidance. Strategies do not differ between treatments.

Table 1. Tax avoidance strategies

Strategy	Acceptance					
	Probability	**Corporate net profit**	**Additional benefit from strategy**	**Group payoff**	**Additional benefit group**	**Subject payoff**
1 No tax avoidance	100%	21 Mio.	0	2.1 Mio.	0	700,000
2 Low tax avoidance	80%	25.5 Mio.	4.5 Mio.	2.55 Mio.	450,000	700,000 plus treatment dependent share of additional benefit
3 High tax avoidance	60%	30 Mio.	9 Mio.	3 Mio.	900,000	700,000 plus treatment dependent share of additional benefit

Strategy	Rejection					
	Probability	**Corporate net profit**	**Additional costs from strategy**	**Group payoff**	**Additional costs group**	**Subject payoff**
1 No tax avoidance	0%	21 Mio.	0	2.1 Mio.	0	700,000
2 Low tax avoidance	20%	18 Mio.	3 Mio.	1.8 Mio.	300,000	700,000 minus treatment dependent share of additional costs
3 High tax avoidance	40%	15 Mio.	6 Mio.	1.5 Mio.	600,000	700,000 minus treatment dependent share of additional costs

The first strategy ("No tax avoidance") is the safe strategy that always leads to a corporate profit after tax of 21 Mio. EC translating into a payoff of 700,000 EC for each of the three subjects in one group. Strategy number two ("Limited tax avoidance") offers potential tax savings of 4.5 Mio. EC (50% of the initial tax payment). In our setting limited tax avoidance is being accepted 80% of the time, resulting in expected corporate profits of 24 Mio. EC, expected group payoffs of 2.4 Mio. EC and expected individual payoffs of 800,000 EC across all treatments. The third strategy ("High tax avoidance") is a riskier strategy with an acceptance rate of only 60% but

potential tax savings of 100% of the initial tax payment. Strategy number 3 again results in expected corporate profits after tax of 24 Mio. EC expected group payoffs of 2.4 Mio. EC and expected individual payoffs of 800,000 EC across all treatments.[13]

The amount of potential tax savings on the company level constitutes our measure of tax avoidance by both individuals and groups in our main analysis. To account for the different risks inherent in the tax positions of strategy 1, 2 and 3, we also study the number of choices per tax avoidance strategy when analyzing the distribution of individual preferences. The number of choices per strategy is important to study the underlying risk positions, as different combinations of strategies may lead to the same average outcome in the level of tax avoidance.[14] It thus enables us to further support statements regarding the distribution of preferences. As pointed out before, the distribution of preferences is critical in order to differentiate the effects of polarization and diversification of opinions in group decision making. For the investigation of group decision processes, we further analyze groups that experience conflict and evaluate group chat protocols. A definition of all variables is included in appendix I.

3.4. Sample Characteristics

The experiment has been conducted in seven sessions at the Magdeburg Experimental Laboratory of Economic Research (MaXLab) in March 2019. Overall, 108 graduate and undergraduate students participated in the experiment. The experiment was organized and recruited with the software hroot (Bock et al., 2014). Table 2 provides an overview of the sample characteristics. The number of observations equals the number of observed individual choices in each of the three remuneration treatments and translates into 29 group observations in the tax avoidance framing.

Table 2. Sample Characteristics

	Tax Avoidance
Female	55%
Age	24.51
Undergraduate	54%
Job experience	68%
Disposable income	<501€
Observations	87

[13] An overview of the tax avoidance strategies including each subject's treatment dependent potential payoff is included in appendix II. A formal proof of the equality of expected payoffs between treatments is included in appendix III.

[14] For example if out of a group of three subjects, all three choose moderate tax avoidance, the average tax avoidance would equal 4.5 EC. If out of the same three subjects one chooses high tax avoidance, one chooses moderate tax avoidance and one chooses no tax avoidance, the average across all three would again be 4.5 EC.

4. Results

4.1. Descriptive Statistics

Treatment differences: Individual decision outcome

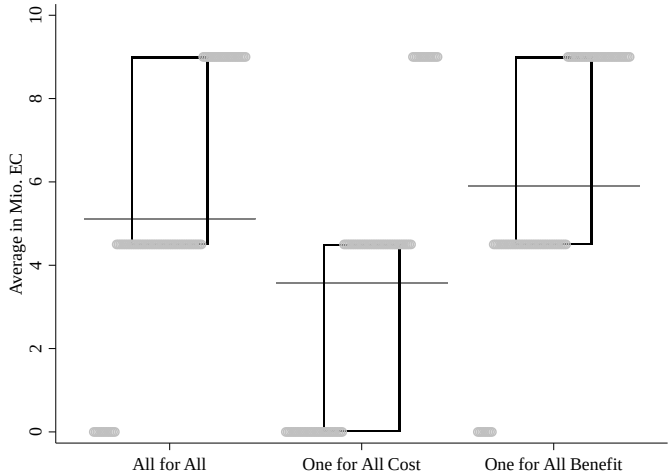

Figure 3. Individual tax avoidance by treatment

In order to test our hypothesis regarding the distribution of individual preferences, Figure 3 gives an overview of the individual decision outcome. A horizontal line indicates the mean level of tax avoidance in each treatment, while boxes capture the central 50% of the distribution. As we employ a within subjects design and our dependent variable, the level of tax avoidance is ratio scaled, we use paired t-tests to test for statistical significance of the differences in individual preferences.[15] We further compare the number of choices per tax avoidance strategy to analyze distributional differences in more detail. As can be seen from the graph, a majority of subjects chooses moderate tax avoidance in treatment *All for All*, with extreme positions resulting at both ends of the risk continuum. We also find a slightly bigger proportion of individuals choosing high tax avoidance as compared to no tax avoidance. Both results are in line with prior research regarding the outcome of the Holt and Laury (2002) lottery choice task.[16] Regarding shifts in the distribution of preferences following intra-group payoff conflict, we find strong support for hypothesis H 1.1 and partially H 1.2. Individual tax avoidance strongly decreases in treatment *One for All Cost*, representing the expected shift in individual preferences based on a biased risk perception. The underlying differences in individual tax avoidance between treatments All for All and One for Cost as well as One for All Benefit and

[15] While being ratio scaled by definition, measurement of our dependent variable in the experimental design is discrete. To ensure robustness of our results, we repeat our analysis using non-parametric tests. All results hold using equivalent non-parametric test statistics. Pairwise comparisons of treatment groups employing Wilcoxon signed-rank tests yield the same results as the presented results based on paired t-tests.

[16] These studies are subsumed in "group 2)" in our literature review.

One for All Cost are both highly significant at a 0.1% level (p-value=0.0003 and p-value=0.0000 respectively). On the other hand the hypothesized increase in tax avoidance between treatment *All for All* and *One for All Benefit* is only marginally significant (p-value=0.0624). Differences in the average level of tax avoidance between treatments are accompanied by the expected shifts in the distribution of individual choices. Deciding individually, participants exhibit strong preferences for the safe strategy of no tax avoidance in treatment One for All Cost. The increase in the underlying number of choices is highly significant as compared to both other treatments.[17] At the other extreme, high tax avoidance is most often chosen in treatment One for All Benefit. The difference in the underlying number of choices is strongly (marginally) significant (p-value=0.0004 and p-value=0.0626 respectively) regarding the comparison to treatments One for All Cost (All for All). One potential explanation for less pronounced effects in treatment One for All Benefit, might be the already high average level of tax avoidance in treatment All for All, or weaker effects regarding probability misjudgments in the profit domain. A discussion of shifts in the individual ratings regarding the underlying risks and chances of strategies in each treatment is included in appendix IV. Before moving on to adaptions due to group discussion it is important to note that the hypothesized shifts in individual preferences can be confirmed overall, building the basis for the competing analysis of *polarization* and *diversification of opinions* in group decision making.

Individual and group tax avoidance within treatments

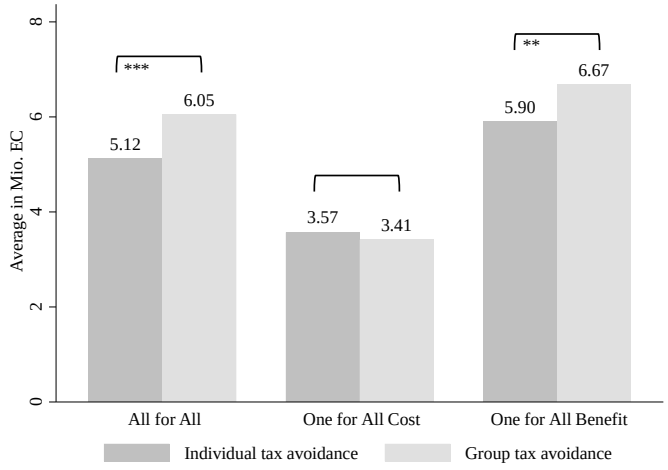

Figure 4. Individual and group tax avoidance by treatment

[17] The two comparisons are: comparison to treatment *All for All* (p-value=0.0001) and comparison to treatment *One for All Benefit* (p-value=0.0000).

An overview of both individual and group tax avoidance in each treatment is given in Figure 4. Stars indicate significance of the difference between individual and group decision outcome within each treatment based on paired t-tests.[18] Based on average outcome we can confirm hypothesis H 2.1, tax avoidance in treatment *All for All* significantly increases following group decisions (p-value=0.0016). This result is in line with our expectation given prior evidence on group risk taking regarding high probability winning lotteries. Whether this effect can primarily be attributed towards a diversification of opinions effect in which low-risk taking individuals switch their position in order to reach compromise or even a polarization towards high-risk taking individuals will be discussed in the further analysis.

Regarding the effects of group decision making in treatment *One for All Cost,* tax avoidance is slightly decreasing on the group level. The direction of this shift would be in favor of a *diversification of opinions effect*. However, we can neither confirm nor reject H 2.2a and H 2.2b. We find no significant difference in average tax avoidance between individuals and groups in treatment One for All Cost (p-value=0.7121). One potential explanation might be that both effects, polarization and diversification, occur at equal strength at the same time. Again, we will discuss this explanation in the further analysis.

At last, regarding the effect of group decision making in treatment *One for All Benefit*, we find evidence in support of hypothesis H 2.3a. Group tax avoidance is significantly higher than individual tax avoidance (p-value=0.0245). This result supports the expectation that extreme individuals, especially those at the safe end of the risk continuum, change their position in order to reach a compromise driven by the majority of individual preferences.

[18] Results hold using equivalent non-parametric test statistics. However the difference between individual and group tax avoidance in treatment One for All Benefit is only marginally significant (p-value=0.0517) based on a Wilcoxon signed-rank test.

Treatment differences: Group decision outcome

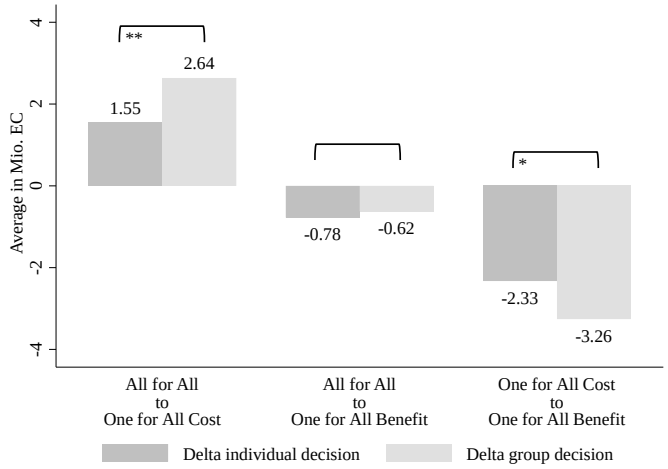

Figure 5. Difference in tax avoidance between treatments based on individual and group decisions

In order to test hypothesis H 3, we use a pairwise difference-in-difference comparison. The first difference is given by the difference between two treatments based on individual decisions. The second difference is given by the difference between the same two treatments based on group decisions. Based on polarization in group discussions, differences based on individual decisions would shrink, and in the extreme case of equally strong polarization effects in treatments *One for All Cost* and *One for All Benefit* even vanish, following group discussions. On the contrary, these differences, the gap between treatments, would widen following group decisions based on a diversification of opinions effect. An overview of the resulting differences between the three treatment pairs is presented in Figure 5. Stars indicate statistical significance between the differences in individual and group decisions based on paired t-tests.[19] With respect to hypothesis H 3, we find mixed results. As can be seen from the graph, we can reject the extreme case of no difference in the level of tax avoidance following group decisions. We therefore conclude that polarization effects are unlikely to be equally strong with respect to intra-group payoff conflict in the profit and cost domain. On the other hand, the difference in the level of tax avoidance between treatments All for All and One for All Cost as well as One for All Cost and One for All Benefit is higher following group decisions as compared to individual decisions. This difference is significant (p-value=0.0235) (marginally significant (p-value=0.0774)) regarding the difference between individual and group decisions between treatments All for All and One for All Cost (treatments One for All Cost and One for All

[19] Results hold using equivalent non-parametric test statistics. However, the difference between treatments One for All Cost and One for All Benefit is not statistically significant (p-value=0.1204) based on a Wilcoxon signed-rank test.

Benefit). The widened gap between treatments following group decisions supports the dominance of a *diversification of opinions effect*. Comparing treatments All for All and One for All Benefit, however, we find a non-significant decrease in the difference in group decision outcome as compared to the difference in individual decision outcome. A result that contradicts the dominance of diversification effects. Nevertheless, the results of both comparisons to treatment *One for All Benefit* are likely driven by the distribution of individual tax avoidance in treatment One for All Benefit. The shift in individual preferences towards higher risk taking in treatment One for All Benefit is weaker than expected, accordingly group adjustments could be expected to be less pronounced as well. In addition, we do find the highest level of tax avoidance by groups in treatment One for All Benefit, followed by treatment All for All, and the lowest level of tax avoidance in treatment One for All Cost. This result supports the argumentation that the *diversification of opinions* effect is stronger than that of *polarization* in group decision making.

4.2. Further analysis

Groups that experience internal conflict

Table 3. Distribution of conflict in group decisions based on individual decision

	Total		All for All		One for All Cost		One for All Benefit	
Unanimity	19	21.84%	8	27.59%	4	13.79%	7	24.14%
All different	12	13.79%	4	13.79%	4	13.79%	4	13.79%
Conflict risky	25	28.74%	5	17.24%	14	48.28%	6	20.69%
Conflict safe	31	35.63%	12	41.38%	7	24.14%	12	41.38%
N	87		29		29		29	
Majority	43	76.79%	14	82.35%	15	71.43%	14	77.78%
Majority conflict risky	17	68.00%	2	40.00%	11	78.57%	4	66.67%
Majority conflict safe	26	83.87%	12	100.00%	4	57.14%	10	83.33%
Minority	10	17.86%	3	17.65%	3	14.29%	4	22.22%
Minority conflict risky	7	28.00%	3	60.00%	2	14.29%	2	33.33%
Minority conflict safe	3	9.68%	0	0.00%	1	14.29%	2	16.67%

Results of a strategy count by separate groups of individual preferences. All variables are Dummy variables. Unanimity equals one if all three group members chose the same strategy individually. All different equals one if the individual choices where strategy 1, strategy 2 and strategy 3. Conflict risky is defined as a situation where only one subject deviates from the majority individual choice of his group towards higher risk taking e.g. choices strategy 1, strategy 1, strategy 2. Conflict safe is defined as a situation where only one subject deviates from the majority individual choice of his group towards lower risk taking e.g. choices strategy 1, strategy 2, strategy 2. Majority equals one if the group outcome of either conflict risky or conflict safe equals the majority individual choice of the group. Minority equals one if either the group outcome of conflict risky or conflict safe is equal to the individual choice of the one deviating subject. Majority (minority) conflict risky and majority (minority) conflict safe are defined in the same manner as majority (minority) but regard the subgroups of possible conflicts separately.

In order to differentiate the effects of *polarization* and *diversification of opinions* further, we now want to study those groups separately that experience conflict with respect to their individual preferences. A similar approach was taken by Zhang and Casari (2012) to shed light

on the average results of group decisions in their experiment. We define group conflict as a situation where only one subjects deviates from the opinion of the other two members of his group. This deviation can either occur towards higher risk taking (individual decisions e.g. strategy 2, strategy 2, strategy 3) or lower risk taking (individual decisions e.gg. strategy 2, strategy 2, strategy 1).[20] In addition to the information provided in Table 3, an overview of conflict distribution in detail by treatments is included in appendix VI. In line with our prior results, 70% of conflicts in treatment All for All are conflicts safe and 53% of conflicts in both directions occur among low and high risk taking individuals. Following the introduction of intra-group payoff conflict these proportions shift in the expected directions.

Across all treatments, we find that the majority opinion within a group prevails following the group decision in approximately 70% to 80% of the cases. The result of 82% majority prevalence in treatment *All for All* is strikingly similar to that found by prior studies. In a comparable treatment, Zhang and Casari (2012) find a majority prevalence in 81.1% of group decisions. A prevalence of the majority of individual opinions in our study is in line with a compromise among group members based on the average opinion and thus an "averaging out" effect of extreme positioned individuals. This supports prior discussed evidence of a *strong diversification of opinions effect*. Further supporting the importance of compromise, overall 75% of groups starting out with three differing opinions (all different) end up choosing strategy 2, the moderate tax avoidance strategy that represents a clear compromise between the extreme strategies no tax avoidance and high tax avoidance.

However, an aggregation rule based solely on the majority of individual preferences, would predict the majority to prevail in 100% of group decisions (also see Nieboer, 2015). Accordingly, we do find evidence of a less pronounced *polarization* effect. We attribute this effect to persuasive argumentation by a minority individual in group discussion. In fact, in treatment All for All we do find higher risk taking minorities to be in an advantaged position regarding their ability to convince their team partners. While no relatively risk averse minority is able to win over his or her partners, 60% of relatively risk loving individuals succeed in convincing their team partners to take higher risks. Similar to this result Zhang and Casari (2012) find minority proposals to be more risky in 63% of minority proposals prevailing.

Regarding treatments *One for All Cost* and *One for All Benefit*, deviations in the direction of conflicts occur in the expected manner. As a majority of individuals shifts towards safety in

[20] We replicate this approach based on the evaluation of chat protocols collected during the experiment. Results of the replication are included in appendix VII. Overall conflict resolution based on chat protocols shows an even stronger majority effect with majority prevailing in 88% of conflicts on average.

treatment One for All Cost, conflicts where only one member of a group deviates towards higher risk taking represent approximately 48% of all group compositions and 66% of all conflicts. Comparable but slightly less pronounced, conflicts where only one group member deviates towards less risk taking represent approximately 41% of group compositions in treatment One for All Benefit. This overall proportion as well as the fact that 67% of conflicts are conflicts safe in treatment One for All Benefit are strikingly similar to results regarding treatment All for All. Nevertheless, the shift in individual preferences towards higher risk taking is reflected in an increase in the proportion of conflicts where two subjects choose high risk taking from 41% in treatment All for All to 56% in treatment One for All Benefit. The smaller magnitude of this shift is in line with our prior results. In line with a missing significant difference between individual and group tax avoidance in treatment One for All Cost, the diversification of opinions effect seems to be weakened as rational arguments can be found for polarization towards both relatively high risk taking and relatively low risk taking members within groups. Relatively high risk taking individuals may argue on the basis of the underlying true probability of actually having to bear potential costs, which is significantly reduced via intragroup payoff conflict, while relatively risk averse minorities may argue based on the fairness of outcomes or the wide range of possible outcomes. As can be seen in Table 3, minority prevalence is exactly equally strong in both directions, higher and lower risk taking in treatment One for All Cost. In treatment One for All Benefit, again, we find quite comparable results to treatment All for All. The majority opinion prevails in 78% of group decisions and a risky minority is more likely to convince his or her group members (33% of conflicts risky). However, overall group tax avoidance is decreased by a *polarization* effect of a risk averse minority (17% of conflicts safe) in treatment One for All Benefit. Potential arguments supporting relatively risk averse minorities may again be based on the fairness of outcomes among group members.

Overall, we find the *diversification of opinions* effect to be stronger than potential *polarization* effects across all treatments. This result is in line with evidence regarding comparisons between individual and group risk taking based on archival data (Adams and Ferreira, 2010; Bär et al., 2011). Nevertheless, *polarization* effects do occur in approximately 18% of all disagreements. Relatively high risk taking individuals appear to be in an advantaged position when it comes to convincing their group partners, given that negative payoff consequences are shared among all

group members. We are going to analyze the course and content of group discussions within the next section.

Evaluation of chat protocols

During the experiment groups where given the opportunity to communicate via the group chat function implemented in z-Tree. We evaluate the chat protocols based on an independent coding of messages by one of the authors and a research assistant. Coding was performed based on the variable definitions included in appendix I. In total 29 groups engaged in 87 group chats with 1227 messages. Disagreements between coders occurred with respect to 40 variable entries. Disagreement was resolved via discussion. In depth comparisons and discussions led to a total of 21 changes in variable entries by the coding author. Table 4 presents the number of risk supporting and risk opposing arguments used in group discussions clustered by the outcome of the three individual preferences in one group. Hereby, we first compare unanimity of individual preferences to the three remaining possible outcomes all different, conflict risky and conflict safe, which are subsumed under conflict.

Table 4. Argumentation by combination of individual decisions

	Total	**All for All**	**One for All Cost**	**One for All Benefit**
	NoA / NoO	**NoA / NoO**	**NoA / NoO**	**NoA / NoO**
Unanimity	**1.74**	**1.13**	**2.75**	**0.86**
Risk supporting arguments	1.00	0.63	1.50	0.86
Risk opposing arguments	0.74	0.50	1.25	0.71
Conflict	**2.57**	**1.95**	**2.88**	**2.82**
Risk supporting arguments	1.68	1.19	1.56	2.27
Risk opposing arguments	0.90	0.76	1.32	0.55
Majority	**2.26**	**1.64**	**1.93**	**3.21**
Majority conflict risky	1.88	1.00	0.91	5.00
Risk supporting arguments	0.94	0.50	0.09	3.50
Risk opposing arguments	0.94	0.50	0.82	1.50
Majority conflict safe	2.50	1.75	4.75	2.50
Risk supporting arguments	1.77	1.00	2.75	2.30
Risk opposing arguments	0.73	0.75	2.00	0.20
Minority	**3.00**	**3.67**	**3.33**	**2.25**
Minority conflict risky	3.14	3.67	3.50	2.00
Risk supporting arguments	2.57	3.00	3.00	1.50
Risk opposing arguments	0.57	0.67	0.50	0.50
Minority conflict safe	2.67		3.00	2.50
Risk supporting arguments	1.33		0.00	2.00
Risk opposing arguments	1.33		3.00	0.50

Results of chat evaluation based on independent coding. NoA/ NoO (number of arguments / number of individual decision outcome) represents the average number of risk arguments per group chat in the respective category. Categories unanimity and conflict as well as conflict risky or conflict safe are defined based on the individual decisions of group members. Majority and minority are defined based on the final group decision. As no minority prevailed in conflict safe in treatment All for All the respective cells are left empty.

Regarding comparisons between groups that agree initially and those that disagree given their individual preferences, results show that discussions are more intensive in groups that disagree. The average increase in arguments from 1.74 to 2.57 appears to be primarily driven by disagreements in treatments with cost sharing. While the highest number of arguments are used in conflicting groups in treatment *One for All Cost*, intra-group payoff conflict in the distribution of costs leads to an equally high average discussion quantity when individuals agree initially. A result which further supports the importance of cost sharing between group members. On the other hand, the gap between initial agreement and conflicting preferences is largest in treatment One for All Benefit. This gap is driven by a quick agreement in group discussion when all individual preferences are aligned needing less than one risk related argument in total. Regarding differences between conflict resolutions, we find that groups where the minority individual position prevails in the group discussion exchange the highest number of arguments in total. This result is in line with both theoretical assumptions regarding the importance of persuasive argumentation in group *polarization* as well as prior results by Zhang and Casari (2012). However, while the average number of arguments strongly increases when minorities prevail in treatments All for All and One for All Cost, the difference reverses in treatment One for All Benefit. A finding that can partially be attributed to risky minorities trying to convince their group members in cases of conflict risky. As categories in Table 4 do not reflect upon the distribution of choices per strategy and we are especially interested in relatively extreme decision outcomes, Table 5 lists the average number of arguments per final group decision.

Table 5. Argumentation by group decision outcome

	Total	**All for All**	**One for All Cost**	**One for All Benefit**
	NoA / NoS	**NoA / NoS**	**NoA / NoS**	**NoA / NoS**
Group decision: No tax avoidance				
Risk supporting arguments	0.45	0.00	0.50	
Risk opposing arguments	1.55	0.00	1.70	
Group decision: Low tax avoidance				
Risk supporting arguments	1.46	0.76	1.63	2.07
Risk opposing arguments	0.98	0.94	1.06	0.93
Group decision: high tax avoidance				
Risk supporting arguments	2.07	1.55	4.67	1.93
Risk opposing arguments	0.39	0.36	1.33	0.21

Results of chat evaluation based on independent coding. NoA (number of arguments) / NoS (number of strategy choices) represents the average number of arguments used by groups choosing a specific strategy. As no group chooses strategy 1 no tax avoidance in treatment One for All Benefit the respective cells are left empty.

Regarding the number of arguments by final strategy choice one result directly draws our attention. To promote a high risk strategy, strategy 3 high tax avoidance, approximately 4.7 risk

supporting arguments are needed in the presence of intra-group payoff conflict in the distribution of costs. On the contrary, only 2 risk supporting arguments are needed when profits are randomly allocated to one group member. The strong increase in the necessary number of arguments needed to support high risk taking in treatment One for All Cost reflects the strong shift in preferences towards less risk taking and again is in line with resulting minorities having to fight harder in order to convince their group. This again supports the importance of persuasive argumentation in group polarization. In comparison in treatments All for All and One for All Benefit a high number of individuals prefers high risk taking, as a consequence it takes less arguments on average to implement a high tax avoidance strategy.

Implementing a moderately risky strategy, low tax avoidance, on the group level takes little argumentation when consequences are shared equally (treatment All for All), while especially risk supporting arguments approximately double in the presence of intra-group payoff conflict. This increase has two plausible explanations, it might represent a high risk minority trying to convince the group to take higher risks or it might represent a majority in favor of moderate risk taking in need to present stronger arguments as they face more contra arguments from risk averse subjects. Untabulated results show that 63% of groups choosing low tax avoidance in treatment One for All Cost consider a lower risk strategy, a result in favor of the second explanation. In treatment One for All Benefit on the other hand, almost 50% of individuals prefer a high risk strategy, a trend supporting the first explanation. With 33% of all conflicts in treatment One for All Benefit being between a moderate risk taking majority and a high risk taking minority, it is likely that high risk taking individuals offer more risk supporting arguments in an attempt to win over their group towards their individual preference. The presence of intra-group payoff conflict in the distribution of profits is likely to increase their willingness to argue for higher risk taking as they strongly focus on the potential, however unlikely, gains. Whether the potential cash payoffs indeed are an important basis for argumentation is our next step in the analysis. Besides the quantity of risk supporting and opposing arguments, we also want to analyze the content of arguments used in group decisions. Table 6 shows the content of risk supporting and risk opposing arguments in detail.

Table 6. Content of arguments in detail

	Total	All for All	One for All Cost	One for All Benefit
	NoA / T	NoA / T	NoA / T	NoA / T
Risk supporting in detail				
Cash	**33%**	**40%**	13%	**45%**
Payoff distribution	11%	7%	13%	10%
Risk/ chance	**36%**	**30%**	**49%**	**29%**
True probability	17%	17%	**24%**	10%
Expected value	4%	7%	0%	5%
Risk opposing in detail				
Cash	27%	**35%**	26%	18%
Payoff distribution	**28%**	0%	**39%**	**35%**
Risk/ chance	**37%**	**55%**	**29%**	**35%**
True probability	5%	5%	5%	6%
Expected value	3%	5%	0%	6%

Results of chat evaluation based on independent coding. NoA (number of arguments in each category) / T (total number of risk supporting or risk opposing arguments) represents the proportion of all risk supporting or risk opposing arguments falling into a specific detail category (e.g. cash). The two highest proportions of arguments in each treatment are highlighted in bold face.

Table 6 shows the proportion of risk supporting and risk opposing arguments split up into five main content categories. A detailed definition of each of the categories including translated example statements is given in appendix I. Regarding the content of arguments across all treatments we notice that most arguments both in support of risk taking as well as against risk taking refer to the risk of loosing or the chance of winning (risk / chance) given a specific strategy. A total of 36% (37%) of all risk supporting (opposing) arguments relate to risks and chances. This strong focus is in line with prior results by Bougheas et al. (2013) who find a strong significant association between risky and cautios statements and group decision outcome. In addition, this result is in line with our prior conclusions regarding the importance of the winning probability of a given lottery and results by Baker et al. (2008). Besides the importance of risks and chances, especially the objective probability (true probability) of receiving a given payoff is mentioned in order to increase risk taking in treatment One for All Cost. Other than statements merely related to high/low risk or chance, statements concerning the true probability also refer to actual numerical probabilities, or combined probabilities such as e.g. in treatment One for All Cost the risk of strategy denial and the additional random selection of one group member who has to bear the costs of strategy failure.[21] In line with reductions of behavioral biases in group discussions (see Charness et al., 2007a, Sutter, 2007) participants frequently refer to objective probabilities in order to support higher risk taking

[21] Statements referring to the random selection of one out of the six decisions made during the experiment in order to determine the final payoff also count as statements referring to true probability.

when being confronted with intra-group payoff conflict in the distribution of costs. This result supports our expectations regarding the advantage of polarization towards higher risk taking in treatment One for All Cost due to the availability of new persuasive arguments. However, we do not find a parallel trend when conflict is introduced into the distribution of profits. While we find a slight increase in the tendency to use risk related arguments in order to oppose risk taking, we also find a manifestation of the focus on potential payoffs in group discussions, represented by a high percentage of risk supporting arguments related to cash payments. Apparently, the focus on potential, however unlikely, gains remains in force in group discussions as long as costs are shared equally. With respect to results by prior research, a strong focus on cash payments and their distribution in group discussions, is in line with prior results by Zhang and Casari (2012). Finally, the increase in risk opposing arguments regarding the distribution of payoffs is in line with our experimental design and confirms an effective treatment manipulation. It further supports the stronger focus on fairness aspects in group decisions. Prior results regarding the importance of the expected value of payoffs (see Bougheas et al., 2013 and Fochmann et al., 2019) cannot be confirmed based on our analysis. However, differences might be related to category definitions applied in the coding of messages as we specifically separated messages regarding possible payoffs and those actually naming expected value.

Overall, our further analysis supports our assumptions regarding the importance of the distribution of individual preferences and a prevalence of a diversification of opinions effect in group decision making as shown by a strong trend towards majority opinions. The relative dominance of a diversification of opinions effect is in line with prior results by field studies comparing individual and group risk taking (Bliss et al., 2008; Adams and Ferreira, 2010; Bär et al., 2011). Furthermore, the strong tendency towards the majority of individual preferences is also in line with prior findings regarding the central tendency of groups towards the median as both are based on the same distributional characteristics (Ambrus et al. 2015; He and Villeval 2017). However, group decisions do not blindly follow a majority rule (also see Nieboer, 2015). Although weaker, we do find evidence supporting a polarization effect in group decisions and especially supporting the importance of persuasive argumentation in order to determine the final group decision.

4.3. Robustness

Order Effects

One of the biggest constraints to within subject experiments is the potential occurrence of order effects. We randomized the order of our treatments in order to control for order effects. When

comparing our results for individual and group tax avoidance across differing periods, we find that the increase in group tax avoidance as compared to individual tax avoidance in treatment *All for All* and *One for All Benefit* is independent of the order of treatments. The direction of group adaption in treatment *One for All Cost* on the other hand appears to be partially driven by prior treatments. The average decrease in the level of tax avoidance following group decisions in the presence of intra-group payoff conflict in the distribution of costs is primarily driven by the last period of the experiment. A potential explanation could be that polarization towards higher risk taking based on argumentation is easier in the first period where only one condition has been experienced yet. In line with this explanation we also find the smallest increase in group tax avoidance in treatment One for All Benefit, reflecting polarization towards safety, in the first period. Another explanation might be an increase in the importance of fairness concerns when having experienced equality first. As the limited number of groups by order in our study does not allow us to clarify this effect, future research is needed in order to validate these explanations. With respect to treatment differences however tax avoidance on both the individual as well as the group level is lowest in treatment One for All Cost, regardless of the order of treatments. Overall, the negative (positive) reaction towards intra-group payoff conflicts regarding costs (benefits) is strongest if subjects experienced both equality of payoffs and benefit (cost) inequality first. Nevertheless, our main results remain unchanged across different orders of treatments.

Generalizability of results: Tax avoidance versus risky investment

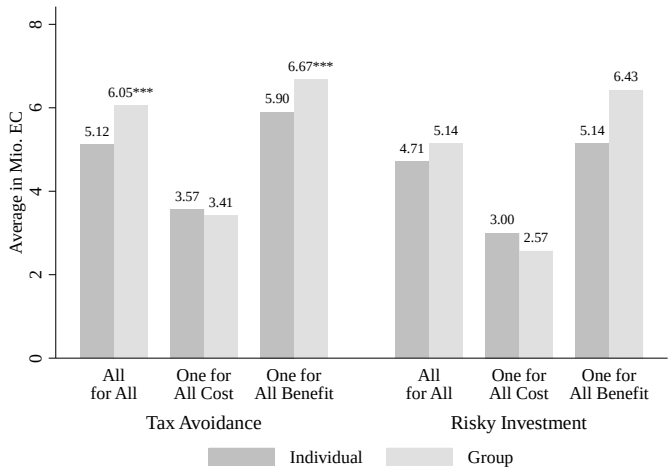

Figure 6. Tax avoidance and risky investment per treatment

In order to verify the generalizability of our results to the general context of risk taking within organizations and to test for potential deviations due to our tax avoidance framing, we repeated our experiment for a small number of subjects using a completely neutral risky investment

framing. Overall, 21 subjects participated in the neutral investment framing. The two groups do not differ significantly with respect to personal characteristics.[22] Comparisons of our results between framings are shown in Figure 6. As can be seen from the graph, participant's behavior follows parallel trends regardless of whether the decision is framed as tax avoidance or risky investment. In line with a dominant diversification of opinions effect, risk taking increases following group decisions as long as negative consequences are shared equally (treatments *All for All* and *One for All Benefit*) and drops if one group member has to pay costs alone (treatment *One for All Cost*). However, presumably due to the higher number of observations, differences between individual and group behavior are only significant regarding our tax avoidance framing. We fail to find significant differences in comparisons between framings in each treatment on both the individual as well as the group level. The generalizability of our results to risk taking is further supported by a lack in chat messages referring to the fiscal context of tax avoidance. In total, only one statement refers to the framing of tax avoidance as anything other than the name of the available strategies.[23] In addition, we asked participants in the tax avoidance framing before and after the experiment to state their acceptance of tax avoidance and participants in the neutral framing to state their acceptance of risky investments. Results regarding the acceptance of both activities by private individuals and companies did not differ significantly. As our main results regarding tax avoidance hold under the neutral risky investment framing and all differences between framings remain insignificant over all comparisons, we conclude that the generalizability of our results to a general risk taking by groups can be confirmed.

5. Conclusion

We study differences between individual and group decision making with respect to risky tax avoidance strategies in the controlled environment of a laboratory experiment. We contribute not only to the understanding of tax avoidance behavior by groups of individuals, but also to the fundamental comprehension of risk preferences. Additionally we provide a direct comparison of tax avoidance and risky investment behavior in the environment of a laboratory experiment. To the best of our knowledge, we are the first to study the effects of intra-group payoff conflicts on group decision making, via the introduction of a random allocation of either costs or benefits of risk taking to only one group member. The random payoff mechanism underlying our definition of intra-group payoff conflict, offers a unique opportunity to study the relative strength of two opposing theories regarding group decision making, polarization

[22] An overview of full sample personal characteristics is presented in appendix V.
[23] The statement sent in treatment One for All Benefit states "high…no money for the government ☺".

and the diversification of opinions. We exploit shifts in individual risk preferences following intra-group payoff conflict in order to form a priori opposing expectations based on these theoretical effects. Overall, our results provide evidence of a dominant effect of a diversification of opinions among group members as compared to a polarization towards relatively extreme group members. However, our results also support the existence of a weaker polarization effect and the importance of argumentation in group decision making. Given shared consequences within a group, higher risk taking individuals appear to be at an advantage when it comes to the persuasion of their group members.

Furthermore, our results strongly support the importance of cost sharing among group members in shaping group preferences. Both individual and group tax avoidance experience a significant decrease if potential costs are randomly assigned to one group member. In situations of shared negative consequences on the other hand group decision making increases risk taking in tax avoidance significantly. Our results show that participants think about legal tax avoidance as a problem of risk taking. All our main results hold under a neutral investment framing.

With respect to external validity, our manipulation of payoff schemes may seem arbitrary, however it was chosen in order to study the opposing effects of polarization and diversification within group adjustments respectively. Our definition of intra-group payoff conflicts further allows us to study differences between cost and profit sharing separately. The small number of subjects commonly participating in experiments as well as the mainly used convenience sample of university students may raise concerns towards the generalizability of results. We therefore call upon future research to test our findings further. Especially the analysis of situations where a majority of individual preferences within a group is aligned however contradicts the resulting minority opinion with a higher number of group observations could significantly strengthen our understanding of risk taking by groups.

Despite potential limitations, we believe that some conclusions for the real world problem of aggressive tax planning by companies can be drawn. With respect to tax avoidance at levels that may be critical from a society perspective, a different mechanism regarding liability within groups may be worth consideration. As we show that the financial consequences for the individual participant are crucial for the decisions taken we deduct that the possibility of personal liability of individual partners, board managers, and staff involved in the decision may support responsible decision making.

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Appendix I

Variable Definition

Name	Measurement	Description
Tax avoidance	{0, 4.5, 9}	The average level of avoided taxes in million ECU
Number of choices per strategy	[0, 87] or [0, 29]	The total number of individuals (groups) choosing a specific strategy
Delta individual decision	{-9, -4.5, 0, 4.5, 9}	The difference in tax avoidance between two treatments based on the individual decisions of one subject
Delta group decision	{-9, -4.5, 0, 4.5, 9}	The difference in tax avoidance between two treatments based on the group decisions of a specific group of subjects
Unanimity	{0, 1}	All three group members choose the same strategy individually
All different	{0, 1}	All three group members choose different strategies individually
Conflict risky	{0, 1}	Only one individual choice deviates from the majority individual choice of the group towards higher risk taking
Conflict safe	{0, 1}	Only one individual choice deviates from the majority individual choice of the group towards lower risk taking
Majority	{0, 1}	The group decision of either conflict risky or conflict safe equals the majority individual choice of the group
Majority conflict risky	{0, 1}	Majority in subgroup conflict risky
Majority conflict safe	{0, 1}	Majority in subgroup conflict safe

Minority	{0, 1}	The group decision of either conflict risky or conflict safe is equal to the individual choice of the one deviating subject in the group
Minority conflict risky	{0, 1}	Minority in subgroup conflict risky
Minority conflict safe	{0, 1}	Minority in subgroup conflict safe

Chat Coding

Risk supporting arguments	[0,)	Sum of all risk supporting arguments per group chat
Risk opposing arguments	[0,)	Sum of all risk opposing arguments per group chat
Risk supporting in detail		
Cash	Per statement {0, 1} and sum on group level [0,)	Cash payoff mentioned to support risk taking
Payoff distribution	Per statement {0, 1} and sum on group level [0,)	Distribution of profits or costs (among group members) mentioned to support risk taking
Risk/ chance	Per statement {0, 1} and sum on group level [0,)	Probability of strategy success or failure mentioned to support risk taking or expression of positive attitude towards risk in general
True probability	Per statement {0, 1} and sum on group level [0,)	Reference to actual (objective) probabilities to support risk taking
Expected Value	Per statement {0, 1} and sum on group level [0,)	Expected value of payoffs mentioned to support risk taking
Risk opposing in detail		
Cash	Per statement {0, 1} and sum on group level [0,)	Cash payoff mentioned to oppose risk taking
Payoff distribution	Per statement {0, 1} and sum on group level [0,)	Distribution of profits or costs (among group members) mentioned to oppose risk taking
Risk/ chance	Per statement {0, 1} and sum on group level [0,)	Probability of strategy success or failure mentioned to oppose risk taking or expression of negative attitude towards risk in general
True probability	Per statement {0, 1} and sum on group level [0,)	Reference to actual (objective) probabilities to oppose risk taking
Expected Value	Per statement {0, 1} and sum on group level [0,)	Expected value of payoffs mentioned to oppose risk taking

Coding of conflict and resolution		
First strategy m1	{1, 2, 3}	First *single* strategy suggested by member 1
First strategy m2	{1, 2, 3}	First *single* strategy suggested by member 2
First strategy m3	{1, 2, 3}	First *single* strategy suggested by member 3
Categories of individual decision outcome per group		
Unanimity	{0, 1}	All three group member's first strategy suggestions are equal
All different	{0, 1}	All three group member's first strategy suggestions differ
Conflict risky	{0, 1}	Only one individual strategy suggestion deviates from the majority suggestion of the group towards higher risk taking
Conflict safe	{0, 1}	Only one individual strategy suggestion deviates from the majority suggestion of the group towards lower risk taking
Majority	{0, 1}	The group decision of either conflict risky or conflict safe equals the majority individual strategy suggestion of the group
Majority conflict risky	{0, 1}	Majority in subgroup conflict risky
Majority conflict safe	{0, 1}	Majority in subgroup conflict safe
Minority	{0, 1}	The group decision of either conflict risky or conflict safe is equal to the strategy suggestion of the one deviating subject in the group
Minority conflict risky	{0, 1}	Minority in subgroup conflict risky
Minority conflict safe	{0, 1}	Minority in subgroup conflict safe

Variables based on number of arguments		
NoA	[0,)	Number of arguments
NoO	[0,29]	Number of individual decision outcome
NoA / NoO	[0,)	The average number of arguments per group chat in a respective category. Categories are defined based on the individual decision outcome of the group
NoS	[0,29]	Number of groups choosing a specific strategy
NoA / NoS	[0,)	The average number of arguments used by groups choosing a specific strategy
T	[0,)	Total number of risk supporting or risk opposing arguments
NoA / T	[0%, 100%]	The proportion of all risk supporting or risk opposing arguments falling into a specific detail category (e.g. cash)

Example statements

Risk supporting in detail	
Cash	Treatment All for All groupID 40 "Honestly, we will make a higher profit with [strategy] 3" Treatment One for All Cost groupID 9 "But you can't go out with those 3 Euros of profit […] come on, let's take [strategy] 3!" Treatment One for All Benefit groupID 18 "I vote for [strategy] 3, because of the possibility to double profit."
Payoff distribution	Treatment All for All groupID 1 "Strategy 2 is fine. [...] and everybody gets a good outcome!" Treatment One for All Cost groupID 16 "but only one of us is losing" Treatment One for All Benefit groupID 8 "[…] one of us could get lucky"
Risk/ chance	Treatment All for All groupID 18 "Come on, at least [strategy] 2, [strategy] 1 is nonsense ☺ everyone needs a little risk ☺" Treatment One for All Cost groupID 37 "in my opinion [strategy] 3 is risky, but the probability that you need to pay is very low" Treatment One for All Benefit groupID 21 "Full on risk! Strategy 3? ;)"

True probability	Treatment All for All groupID 16 "If you're willing to take risk, 20% difference are small compared to the doubled return" Treatment One for All Cost groupID 18 "You only lose with a probability of 20%, […] and even then only with 1/3" Treatment One for All Benefit groupID 32 "With low tax avoidance, the chance for each one of us to get a higher payoff is still higher than that of everyone getting less, 23% versus 20%"
Expected Value	Treatment All for All groupID 10 "[Strategy] 2 and 3 should have the same [EV]" Treatment One for All Cost – none Treatment One for All Benefit groupID 6 "So the expected value supports high tax avoidance"

Risk opposing in detail	
Cash	Treatment All for All groupID 38 "Yes, [strategy] 3 is not very profitable" Treatment One for All Cost groupID 16 "In favor of strategy 1 8.50 € instead of 7 € do not make much of a difference" Treatment One for All Benefit groupID 39 "[…] and you do not get that much more with [strategy] 3"
Payoff distribution	Treatment All for All – none Treatment One for All Cost groupID 15 "with [strategy] 1 no one has to pay the costs alone" Treatment One for All Benefit groupID 39 "only one of us is getting double [payoff]…"

Risk/ chance	Treatment All for All groupID 38 "I agree, the risk is too high" Treatment OfAC groupID 40 "[strategy] 3 is way too risky" Treatment OfAC groupID 9 "I still vote for [strategy] 2. I am not very much in favor of extreme risks either."
True probability	Treatment AfA groupID 14 "but despite 40% I don't think it [strategy 3] will be accepted […]" Treatment OfAC groupID 37 "true, […], but 60% is not thaaaat high ;)" Treatment OfAB groupID 5 "with 33%, but only one of us is getting something"
Expected Value	Treatment AfA groupID 34 "[…] I vote for strategy 2. The expected value is the same as for strategy 3 - but the risk is lower. […]" Treatment OfAC – none Treatment OfAB groupID 6 "so the expected value […] isn't that much higher with high[tax avoidance]"

Appendix II

Payoff Matrix

Table 7. Treatment All for All

Strategy	Acceptance				Rejection			
	Probability	Corporate net profit	Group payoff	Subject's payoff	Probability	Corporate net profit	Group payoff	Subject's payoff
1 No tax avoidance	100%	21 Mio.	2.1 Mio.	700,000	0%	21 Mio.	2.1 Mio.	700,000
2 Low tax avoidance	80%	25.5 Mio.	2.55 Mio.	850,000	20%	18 Mio.	1.8 Mio.	600,000
3 High tax avoidance	60%	30 Mio.	3.0 Mio.	1 Mio.	40%	15 Mio.	1.5 Mio.	500,000

Table 8. Treatment One for All Cost

Strategy	Acceptance				Rejection			
	Probability	Corporate net profit	Group payoff	Subject payoff	Probability	Corporate net profit	Group payoff	Subject payoff
								Not cost payer / Cost payer
1 No tax avoidance	100%	21 Mio.	2.1 Mio.	700,000	0%	21 Mio.	2.1 Mio.	700,000 / 700,000
2 Low tax avoidance	80%	25.5 Mio.	2.55 Mio.	850,000	20%	18 Mio.	1.8 Mio.	700,000 / 400,000
3 High tax avoidance	60%	30 Mio.	3.0 Mio.	1 Mio.	40%	15 Mio.	1.5 Mio.	700,000 / 100,000

Table 9. Treatment One for All Benefit

Strategy	Acceptance					Rejection			
	Probability	Corporate net profit	Group payoff	Subject payoff		Probability	Corporate net profit	Group payoff	Subject payoff
				Not success originator	Succes originator				
1 No tax avoidance	100%	21 Mio.	2.1 Mio.	700,000	700,000	0%	21 Mio.	2.1 Mio.	700,000
2 Low tax avoidance	80%	25.5 Mio.	2.55 Mio.	700,000	1,15 Mio	20%	18 Mio.	1.8 Mio.	600,000
3 High tax avoidance	60%	30 Mio.	3.0 Mio.	700,000	1,6 Mio.	40%	15 Mio.	1.5 Mio.	500,000

Appendix III

Expected Payoffs tax avoidance strategies

Parameter:

I = Income (Total income)

x = Taxable income depending on aggressiveness of tax strategy

t = tax rate

p(x) = probability of acceptance of tax strategy

r = cost of non-acceptance

q = personal risk/chance of "responsibility"

n = number of subjects per group

Treatment All for All:

Expected profit for subject i:

$$E_i(\pi) = p(x) \cdot \left[\frac{I(1-t)}{n} + \frac{(I-x) \cdot t}{n}\right] + \big(1 - p(x)\big) \cdot \left[\frac{I(1-t)}{n} - \frac{(I-x) \cdot t \cdot r}{n}\right]$$

Treatment One for All Cost:

Expected profit for subject i:

$$E_i(\pi) = p(x) \cdot \left[\frac{I(1-t)}{n} + \frac{(I-x)\cdot t}{n}\right]$$

$$+ \left(1-p(x)\right)\cdot q \cdot \left[\frac{I(1-t)}{n} - (I-x)\cdot t \cdot r\right]$$

$$+ \left(1-p(x)\right)\cdot (1-q)\cdot \frac{I(1-t)}{n}$$

Substitution $\frac{1}{n}$ for q => q = $\frac{1}{n}$

$$E_i(\pi) = p(x) \cdot \left[\frac{I(1-t)}{n} + \frac{(I-x)\cdot t}{n}\right]$$

$$+ \left[\left(1-p(x)\right)\cdot \frac{1}{n} \cdot \frac{I(1-t)}{n}\right] - \left[\left(1-p(x)\right)\cdot \frac{1}{n}\cdot (I-x)\cdot t \cdot r\right]$$

$$+ \left[\left(1-p(x)\right) \cdot 1 \cdot \frac{I(1-t)}{n}\right] - \left[\left(1-p(x)\right) \cdot \frac{1}{n}\cdot \frac{I(1-t)}{n}\right]$$

$$E_i(\pi) = p(x) \cdot \left[\frac{I(1-t)}{n} + \frac{(I-x)\cdot t}{n}\right]$$

$$+ \left[\left(1-p(x)\right)\cdot \frac{1}{n} \cdot \frac{I(1-t)}{n}\right] - \left[(1-p(x))\cdot \frac{(I-x)\cdot t\cdot r}{n}\right]$$

$$+ \left[\left(1-p(x)\right) \cdot \frac{I(1-t)}{n}\right] - \left[\left(1-p(x)\right) \cdot \frac{1}{n}\cdot \frac{I(1-t)}{n}\right]$$

$$E_i(\pi) = p(x) \cdot \left[\frac{I(1-t)}{n} + \frac{(I-x)\cdot t}{n}\right] + \left(1-p(x)\right)\cdot \left[\frac{I(1-t)}{n} - \frac{(I-x)\cdot t\cdot r}{n}\right]$$

=> Equal to expected profit $E_i(\pi)$ of treatment All for All

Treatment One for All Benefit

Expected profit for subject i:

$$E_i(\pi) = p(x) \cdot q \cdot \left[\frac{I(1-t)}{n} + (I-x) \cdot t\right]$$

$$+p(x) \cdot (1-q) \cdot \left[\frac{I(1-t)}{n}\right]$$

$$+\left(1-p(x)\right) \cdot \left[\frac{I(1-t)}{n} - \frac{(I-x) \cdot t \cdot r}{n}\right]$$

Substitution $\frac{1}{n}$ for q => q = $\frac{1}{n}$

$$E_i(\pi) = p(x) \cdot \left[\frac{1}{n} \cdot \frac{I(1-t)}{n}\right] + p(x) \cdot \left[\frac{1}{n} \cdot (I-x) \cdot t\right]$$

$$+p(x) \cdot \left[1 \cdot \frac{I(1-t)}{n}\right] - p(x) \cdot \left[\frac{1}{n} \cdot \frac{I(1-t)}{n}\right]$$

$$+\left(1-p(x)\right) \cdot \left[\frac{I(1-t)}{n} - \frac{(I-x) \cdot t \cdot r}{n}\right]$$

$$E_i(\pi) = p(x) \cdot \left[\frac{1}{n} \cdot \frac{I(1-t)}{n}\right] + p(x) \cdot \left[\frac{(I-x) \cdot t}{n}\right]$$

$$+p(x) \cdot (1) \cdot \left[\frac{I(1-t)}{n}\right] - p(x) \cdot \left[\frac{1}{n} \cdot \frac{I(1-t)}{n}\right]$$

$$+\left(1-p(x)\right) \cdot \left[\frac{I(1-t)}{n} - \frac{(I-x) \cdot t \cdot r}{n}\right]$$

$$E_i(\pi) = p(x) \cdot \left[\frac{I(1-t)}{n} + \frac{(I-x) \cdot t}{n}\right] + \left(1-p(x)\right) \cdot \left[\frac{I(1-t)}{n} - \frac{(I-x) \cdot t \cdot r}{n}\right]$$

=> Equal to expected profit $E_i(\pi)$ of treatment All for All

Appendix IV

Fairness & Risk (Chance) Perception by Treatment

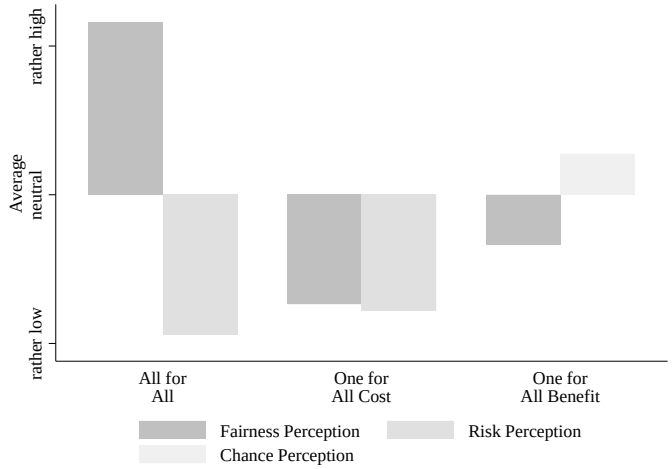

Figure 7. Fairness and risk/ chance perception per treatment

Two possible explanations for differences in tax avoidance and risk taking across treatments are the inherent inequality in the payoff schemes in treatments *One for All Cost* and *One for All Benefit* as well as differences in personal risk and the perception thereof. In order to be able to analyze potential effects of inequality, we asked participants to evaluate the fairness of the distribution of costs and benefits of tax avoidance on a scale from very low to very high for each treatment. In addition, participants had to rate the risk of having to bear the cost in treatment *One for All Cost*; and the chance of being paid the additional profit in treatment *One for All Benefit*. In treatment *All for All* participants simply had to rate the probability of strategy failure. Risk as well as chance perceptions had to be rated with respect to strategy 2 "Low tax avoidance". Results for both fairness as well as risk and chance evaluation are shown in Figure 7.

As expected, fairness was rated significantly higher when both costs and benefits of risky tax avoidance were shared equally among participants. However, fairness was also rated significantly higher when benefits were distributed unequally as compared to sharing costs unequally. The slight decrease in tax avoidance by groups in treatment One for All Cost is in line with the significant drop in fairness ratings and the following attempt to achieve an equal distribution of resources among group members. High fairness ratings in treatment One for All Benefit might be contributing to weaker polarization effects towards safety, as especially the inequality in the distribution of payoffs offers strong arguments against risk taking.

Risk perception in treatment *One for All Cost*, as shown in Figure 7, is in line with subjects overestimating the small probability of receiving a comparatively very low payoff (actual probability 6.66%). The increase in risk evaluation as compared to treatment All for All is in line with subjects focusing on their own risk and suffering from a pessimism bias. This trend supports the notion that the decrease in tax avoidance on the individual level in treatment One for All Cost occurs due to a biased risk perception. The increase in ratings when comparing the perception of a risk of 20% (All for All) to a chance of 26.66% (*One for All Benefi*t) is rather large given the underlying probabilities. This tendency further supports the idea of subjects focusing on themselves when evaluating risks and chances and is in line with an optimism bias regarding the occurrence of good events. Overall risk (chance) ratings are in line with our expectations regarding the occurrence of biases due to intra-group payoff conflicts and the resulting shifts in individual preferences.

Appendix V

Table 10. Full Sample Characteristics

	All	**Tax Avoidance**	**Risky Invest**
Female	57%	55%	67%
Age	24.40	24.51	23.95
Undergraduate	56%	54%	62%
Job experience	69%	68%	76%
Disposable income	<501 €	<501€	< 501€
Observations	108	87	21

Appendix VI

Distribution of conflicts based on individual decisions across treatments

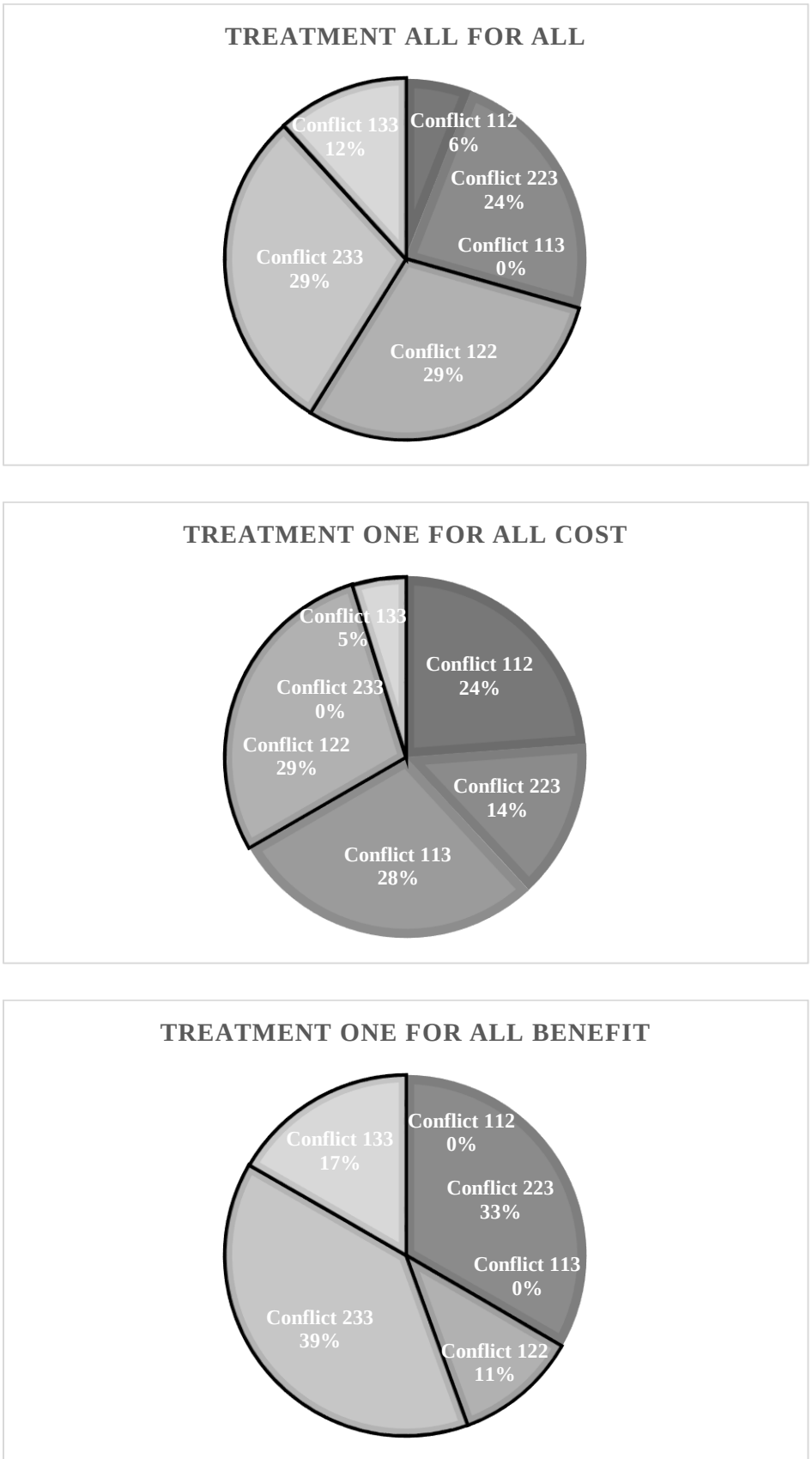

Figure 8. Distribution of conflict across treatments

Appendix VII

Table 11. Majority and minority resolution of conflicts based on group chat protocols

	Total		All for All		One for All Cost		One for All Benefit	
Unanimity	47	55.95%	18	69.23%	13	44.83%	16	55.17%
All different	2	2.38%	1	3.85%	1	3.45%	0	0.00%
Conflict risky	17	20.24%	2	7.69%	10	34.48%	5	17.24%
Conflict safe	18	21.43%	5	19.23%	5	17.24%	8	27.59%
N	84		26		29		29	
Majority	31	88.57%	6	85.71%	13	86.67%	12	92.31%
Majority conflict risky	15	88.24%	1	50.00%	9	90.00%	5	100.00%
Majority conflict safe	16	88.89%	5	100.00%	4	80.00%	7	87.50%
Minority	3	8.57%	1	14.29%	1	6.67%	1	7.69%
Minority conflict risky	2	11.76%	1	50.00%	1	10.00%	0	0.00%
Minority conflict safe	1	5.56%	0	0.00%	0	0.00%	1	12.50%
Conflict Total	35		7		15		13	

Appendix VIII

Experimental instructions

Basic problem at company level (Identical in ALL periods**)**

The profit before taxes of your company is 30 million EC (30 Mio. EC). This profit is subject to a tax burden of 30%. Accordingly, the profit after taxes is 21 Mio. EC. This net profit is certain if you choose strategy 1 "no tax avoidance".

As a board member you have the opportunity to lower your tax burden and thereby raise the net profit of your company (***tax avoidance strategy***). Alongside strategy 1 you will have two such tax avoidance strategies to choose from. These strategies may or may not be successful. Whether a strategy is successful or not depends on its acceptance by the tax authorities. Both strategies lead to higher net profits if they are successful (acceptance). However, if the tax authorities do not accept your chosen strategy (rejection), there will be additional administrative costs. Please note that tax avoidance is not the same as tax evasion. The additional costs in case of a rejection of your strategy, among other things, arise through necessary negotiations with the tax authorities and the corrections that have to be made, not through penalties.

Strategy 2 "low tax avoidance" and strategy 3 "high tax avoidance" differ in the probability at which the tax authorities will accept the strategy and the amount of achievable tax savings (or rather remaining net profits). The audit through the tax authorities is done periodically. Therefore, the tax authorities decide each period anew on the acceptance or rejection of a chosen strategy. The result of the audit as well as your resulting compensation depending on the current remuneration system will be disclosed at the end of the third period.

Strategy		**Acceptance**			**Rejection**		
		Probability	**Corporate net profit**	**Your compensation**	**Probability**	**Corporate net profit**	**Your compensation**
1	No tax avoidance	100%	21 Mio.	dependent on the renumeration system	0%	21 Mio.	dependent on the renumeration
2	Low tax avoidance	80%	25.5 Mio.	dependent on the renumeration system	20%	18 Mio.	dependent on the renumeration
3	High tax avoidance	60%	30 Mio.	dependent on the renumeration system	40%	15 Mio.	dependent on the renumeration

Strategy decision procedure (Identical in ALL periods**)**

You are not the only board member. There are another two members on the board besides you.

Therefore, in each period you will be asked to make two consecutive strategy decisions. You will make the first strategy decision alone (individual strategy decision) and the second strategy decision together with the other participants (group strategy decision). In each decision you can only choose one of the tax avoidance strategies mentioned above.

Individual strategy decision

Irrespective of the existence of the other board members you will initially decide alone which of the tax avoidance strategies you want to choose. This decision has no consequences for the other board members. Only your own compensation will be affected by the acceptance or rejection of your chosen tax avoidance strategy by the tax authorities.

Group strategy decision

After you have made your individual strategy decision, you will have the opportunity to communicate with the other board members via chat. In each period, you will be given 7 minutes to discuss which of the three tax avoidance strategies you want to choose as a group. A clock at the upper right corner of the monitor will show you the remaining time decision making. After your time has run out you must make a joint, uniform strategy decision. Should you choose a different strategy than the other board members an error message will be shown and you cannot immediately proceed with the experiment. Your compensation as well as that of your group members will be determined based on the remuneration system of the period and the acceptance or rejection of your jointly chosen strategy by the tax authorities.

Treatment All for All (Period X)

Remuneration model of the current period:

In accordance with the supervisory board resolution, the management board members will receive 10% of the company's net profit as remuneration. The net profit is determined by the chosen tax avoidance strategy and its acceptance or rejection. The board remuneration will be split equally among the board members. The respective share will be paid to each member as compensation.

Your personal compensation based on the current remuneration model is calculated depending on your chosen strategy and the acceptance or rejection of that strategy as follows:

Strategy	Acceptance			Rejection		
	Probability	Corporate net profit	Your compensation	Probability	Corporate net profit	Your compensation
1 No tax avoidance	100%	21 Mio.	700,000	0%	21 Mio.	700,000
2 Low tax avoidance	80%	25.5 Mio.	850,000	20%	18 Mio.	600,000
3 High tax avoidance	60%	30 Mio.	1 Mio.	40%	15 Mio.	500,000

Please select the strategy that you chose ***individually***

(**Individual strategy decision X**):

○ strategy 1 ○ strategy 2 ○ strategy 3

Please answer the following additional questions:

Please rate the risk of a rejection of strategy 2 (“low tax avoidance”).

○	○	○	○	○	○	○
very low	low	rather low	neutral	rather high	high	very high

Please rate the fairness of the distribution of costs and benefits of tax avoidance among the board members in case of group decision making.

○	○	○	○	○	○	○
very unfair	unfair	rather unfair	neutral	rather fair	fair	very fair

Please confirm your strategy decision by clicking “Next”. By clicking “Next” you will be automatically forwarded to the group strategy decision

Treatment One for All Cost (Period X)

Remuneration model of the current period:

In accordance with the supervisory board resolution, the management board members will receive 10% of the company's net profit as remuneration. The net profit is determined by the chosen tax avoidance strategy and its success or failure. If the chosen strategy is successful, this remuneration will be split equally among the board members and the respective share will be paid out to each member as compensation. If the chosen strategy is not successful (rejection), one of the 3 board members will be chosen randomly and appointed as cost payer of the strategy. This board member and only this board member has to pay the additional costs resulting from the rejection of the strategy. The probability that you will be chosen as cost payer is 1/3.

Your personal compensation based on the current remuneration model is calculated depending on your chosen strategy and the acceptance or rejection of that strategy as follows:

Strategy		Acceptance			Rejection			
		Probability	Corporate net profit	Your compensation	Probability	Corporate net profit	Your compensation	
							Not cost payer	Cost payer
1	No tax avoidance	100%	21 Mio.	700,000	0%	21 Mio.	700,000	700,000
2	Low tax avoidance	80%	25.5 Mio.	850,000	20%	18 Mio.	700,000	400,000
3	High tax avoidance	60%	30 Mio.	1 Mio.	40%	15 Mio.	700,000	100,000

Please select the strategy that you chose ***individually***

(**Individual strategy decision X**):

○ strategy 1 ○ strategy 2 ○ strategy 3

Please answer the following additional questions:

Please rate the risk of a rejection of strategy 2 (“low tax avoidance”) for which you will be chosen to pay the cost?

○	○	○	○	○	○	○
very low	low	rather low	neutral	rather high	high	very high

Please rate the fairness of the distribution of costs and benefits of tax avoidance among the board members in case of group decision making.

○	○	○	○	○	○	○
very unfair	unfair	rather unfair	neutral	rather fair	fair	very fair

Please confirm your strategy decision by clicking “Next”. By clicking “Next” you will be automatically forwarded to the group strategy decision

Treatment One for All Benefit (Period X)

Remuneration model of the current period:

In accordance with the supervisory board resolution, the management board members will receive 10% of the company's net profit as remuneration. The net profit is determined by the chosen tax avoidance strategy and its success or failure. If the chosen strategy is successful, one of the 3 board members will be chosen randomly and appointed as success originator of the strategy. This member will be granted the entire increase in net profit due to the lower tax burden as a bonus compensation. The probability that you will be chosen as success originator is 1/3.If the chosen strategy is not successful (rejection), the remuneration will be split equally among the board members and the respective share will be paid out to each member as compensation.

Your personal compensation based on the current remuneration model is calculated depending on your chosen strategy and the acceptance or rejection of that strategy as follows:

Strategy		Acceptance				Rejection		
		Probability	Corporate net profit	Your compensation		Probability	Corporate net profit	Your compensation
				Not succsess originator	Success originator			
1	No tax avoidance	100%	21 Mio.	700,000	700,000	0%	21 Mio.	700,000
2	Low tax avoidance	80%	25.5 Mio.	700,000	1,15 Mio	20%	18 Mio.	600,000
3	High tax avoidance	60%	30 Mio.	700,000	1,6 Mio.	40%	15 Mio.	500,000

Please select the strategy that you chose ***individually***

(**Individual strategy decision X**):

○ strategy 1 ○ strategy 2 ○ strategy 3

Please answer the following additional questions:

Please rate the chance of an acceptance of strategy 2 (“low tax avoidance”) for which you will be chosen to get the profit?

○	○	○	○	○	○	○
very low	low	rather low	neutral	rather high	high	very high

Please rate the fairness of the distribution of costs and benefits of tax avoidance among the board members in case of group decision making.

○	○	○	○	○	○	○
very unfair	unfair	rather unfair	neutral	rather fair	fair	very fair

Please confirm your strategy decision by clicking “Next”. By clicking “Next” you will be automatically forwarded to the group strategy decision.

Instruction group discussion (Identical in ALL periods)

By clicking on “Next” you will be automatically forwarded into the discussion phase for your group decision. As soon as all members of your group have reached the discussion phase, your 7–minute board meeting will begin.

The group chat that you can use to communicate with the other board members is shown in the middle of your screen. You can enter your messages to the remaining board members into the blue field. Press “Enter” to send your messages. All messages will be listed one below the other.

The clock in the upper right corner of your screen will show your remaining time to reach a group decision *in seconds*.

If you do not have any further questions regarding the general procedure of the group discussion, please click “Next”.

Instruction Group Decision

Please select the strategy that you chose jointly ***as a group*** (**group decision X**):

○	○	○
strategy 1	strategy 2	strategy 3

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