The effect of identity on distributional rules and productivity: An experimental study on heterogeneous self-managed teams.

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Abstract

This paper experimentally explores the extent to which social identity affects distributional preferences and wealth creation in team production technologies with multiple resource owners of different skills and self managed organization. Previous research on social preferences suggests that individuals have preferences for equal output sharing rules and research on group identity indicates that induced identity contributes to overcome free riding behaviour when compensation of resource owners depends on the team production output. This research, however, assumes individuals with equal skills, where equal sharing is both, second best optimal and equality preserving. In this paper we extend the analysis of team production and self-management organization to situations where the heterogeneity of skills creates a conflict between unequal, second best efficient, output sharing rules, and individuals’ preferences for equal output sharing.

Our results indicate that induced group identity prompts preferences for equality even at the expense of wealth created as well as it affects posterior decisions on resource contributions to joint production. We find that albeit group identity curves down free riding decisions it does not increase team efficiency when compared to a setting without social interaction.

JEL Classification: C92, D63, J33, M52, Z13

Keywords: Team decision-making; Heterogeneous groups; Social identity; Distributional preferences; Compensation schemes; Experiments.

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I. Introduction:

“From each according to his ability, to each according to his needs!”
Marx, 1875

The design of incentive schemes in teamwork is one of the more challenging tasks in management and labour economics due to its social and economic components. In the last decades there have been important developments on this line of research. However, little is known about output distributional rules among individuals with diverse skills who collaborate in team production under self-management organization. Consider, for example, the range of abilities in university’ research groups or in medical and lawyer partnerships. Deciding upon a distributional rule that doesn’t damage personal relations and work motivation is a social and economic dilemma.

In this article we try to cover this gap by examining, in an experimental way, how individuals of different attributed skills choose the output sharing rule in team production under self-management organization and how social identity affects these choices. Moreover we investigate how the chosen distributional rule affects input decisions and total wealth created.

Standard economic theory suggests that team production under self-management organization is inefficient because individual productivity is difficult to measure. The argument is that agents shirk because they must share their marginal benefit of effort with others but bear the cost alone. (Alchian and Demsetz, 1972). Holmstrom (1982) proved that there is no sharing formula that satisfies the budget constraint as equality and that gives a total wealth created by the team equal to the socially efficient one. However, much less has been investigated about the second best sharing rules that is, the choice of the sharing rule that maximizes social welfare subject to the Nash equilibrium solution from individual decisions on the choice of the inputs supplied to production.

Most of the research on team incentives considers symmetric members, where equal sharing is second best sharing rule. However, in teams composed by members who differ in productivities the second best distributional rule is proportional to members’ productivities and the equal sharing rule should not be used as it damages
efficiency (Farrel and Scotchmer, 1988; Marreiros, 2010). Nonetheless, empirical evidence on self-managed teams indicates that this is the most used compensation scheme (see for example Encinosa, et al., 2007).

Some reasons pointed out in the literature are connected to theories of justice that incorporate a concern for the well-being of the least well-off members of the society. Examples are Rawlsian preferences for equality or the need principle, which calls for the equal satisfaction of the basic needs (see Konow, 2003 for an extensive review on theories of justice). Other reasons are connected with difference aversion theories supported by experimental evidence that suggests that some individuals dislike inequitable outcomes (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000; Charness and Rabin, 2002) or fairness considerations (Akerlof and Yellen 1990; Rabin, 1993). However, most of the difference aversion experiments consider homogenous subjects.

Social identity is also pointed out as a phenomenon that prompts actions that favour the group instead of self-maximization (Tajfel and Turner, 1979, Ashforth et al, 1989; Akerlof and Kranton 2000, 2005, 2008; Chen and Li, 2009; Klor and Shayo, 2010). According to the social identity theory, if individuals are identified with the group they belong to, they will take actions that are congruent to the prescribed behaviour for the group, even if those actions depart from self-maximization and imply a monetary loss. However, group identity experiments mainly focus on ingroup versus outgroup interactions. One exception is Eckel and Grossman (2005) who find that manufactured identity lead to an increase in cooperation. Nevertheless, once again, they just consider homogenous members.

Therefore, in this paper we try to contribute to management and economic literature by combining the social identity and the social preferences streams of research in a team production technology setting that allows for diversity.

To this aim we design an experiment, based on a team production model, where groups, composed by members who differ in abilities, have to decide how to distribute the team production in a first stage, by simple majority rule, and make their contributions in a second stage. In the first stage they are given three options: an equal distribution rule; a distribution rule that is proportional to members abilities and that maximizes team welfare, which is the second best sharing rule, and a median sharing rule that gives part to needs and part to abilities, i.e. is part egalitarian and part proportional. We compare a setting where no group interaction is permitted to a
setting where identity is manufactured in a pre-stage game and communication is allowed in the voting stage. The first treatment allows us to understand subjects’ distributional preferences and the second treatment allows to study the effect of group identity on those preferences.

Upon the decision on how to distribute benefits, individuals could be conflicted between what is the best for them and what the group or even the society expects them to do. Therefore, we conjecture that although some individuals can have preferences for equality or can be difference averse, being in a group that shares sentiments of group identity can condition individual’s fairness considerations and influence their actions.

Our results strongly confirm this conjecture. In our baseline treatment, where no interaction was allowed, we find that about 70 percent of subjects show self-maximization preferences. Most interestingly, we find that the percentage of high ability subjects that vote for an equal share increase from 33 percent in the control treatment (being the majority females) to 67 percent in the identity treatment.

Moreover, we find that the percentage of groups that choose to perform under an equal share increase from 55 percent in the control treatment to 90 percent in the identity treatment. However, identity failed to increase team efficiency when groups performed under this distributional rule, as it didn’t affect high abilities effort decisions. Nonetheless, when groups performed under the median share it highly increased team revenue.

Therefore our conjecture that group identity increases effort levels and lead to higher creation of wealth when compared to a setting without identity culture is confirmed only in the case where groups opt for proportional compensation schemes.

The rest of the paper is organized as follows. Section II reviews the theoretical and experimental literature on group identity and social preferences. Following, section III presents the experimental design where the theoretical framework, the design of the experiment and its implementation are described. In section IV our conjectures on results are presented and our experimental results are described in section V. Section VI concludes.
II.  Related literature

In this section we revise the literature that are more related to our research.

A. Team production and shirking

Self-managed teams have grown rapidly in popularity following their introduction in the 1960s. Around 80 percent of companies in the Fortune 1000 and 81 percent of manufacturing companies use self-managed teams within their organizational structure (Lawler et al., 1995). Because of their widespread use, much research has been devoted to analyze how to increase their productivity and efficiency.

Alchian and Demsetz (1972) pioneer on the study of team production. They defined “team production” as production technologies that use multiple inputs and the total output from joint production is above the sum of the outputs obtained separately from each input\(^1\). The organizational design problem in team production occurs when each input belongs to a different owner that must decide to collaborate in the joint production and the amount of input contribution. As output contributions from each collaborating resource owner are not measureable, making payments accordingly becomes a very complex task. It consists on setting a rule that assigns total output produced by the team to each resource owner that will, in turn, decide the amount of input contribution by utility maximizing behavior. Nevertheless, Alchian and Demsetz (1972) alert about the free riding behavior and socially inefficient outcome from self-managed teams.

The key decision variable in solving the organization problem through self-managed teams is choosing the output sharing rule. Holmstrom (1982) proved that there exists no sharing rule that yields an efficient outcome when the joint output is fully shared among the agents.

B. Theories of justice and social preferences

The conflict between equality and efficiency has been continuously present in economic environments, since Adam Smith (1759), Marx (1875) and Rawls (1971) to the present day. The impact that distributional preferences have on economic

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\(^1\) Given the production function \(y=F(x_1, \ldots, x_N)\) with \(N\) inputs and quantities \(x_n\), the function satisfies the team production condition if the cross derivative of \(F()\) with respect to input quantities \(x_i\) and \(x_j\) is positive. This implies \(F(x_1, \ldots, x_N) > \sum F(x_i, x_j = 0)\). Team production technology is that where inputs are complementary so higher use of resource \(i\), implies higher productivity of resource \(j\).
outcomes has been discussed under several theories of justice during the past years, however, in the last decade the social preferences literature has been given a great deal of attention due to the growing number of economic experiments finding discrepancies between efficiency and equality in agents’ behavior. Therefore, researchers start to develop models of difference aversion to explain non self-interest behavior in economic experiments that replicate games such as the dictator or the public-good game. These models are based on the premise that people are self-interested, but may also be concerned about the payoff of others.

Fehr and Schmidt (1999) and Bolton and Ockenfels (2000) models assume that players are motivated to reduce differences between theirs and other’s payoffs as some individuals dislike outcomes that are perceived as inequitable. According to them in addiction to pure selfish subjects, there are subjects who dislike inequitable outcomes, losing utility when they are better or worse off then their fellow participants. They argue that in an experimental context, individuals enter at the laboratory as equals, without knowing anything about each other and are given random roles. Because of that subjects consider an egalitarian outcome as equitable. This assumption indicates that subject’s definition of an equitable outcome is context depend. However their work does not address efficiency considerations as a motive. Following on the development of social preferences theories, Charness and Rabin (2002) model includes efficiency motives along with fairness, but do not predict the relative strength of efficiency and distribution motives when the two are in conflict. Experimental evidence on dictator games show that subjects tend to choose distributions that maximize total surplus over more equal or even that favour themselves (Hoffman and Spitzer (1985), Charness and Grosskopf (2001), Charness and Rabin, 2002).

Although these models could explain many experimental results in distribution preferences they do not consider the effects of corporate culture on preferences and on group productivity. Even though we acknowledge that individual preferences for equality can be driven by difference aversion, as we focus on non-observable individual contributions our emphasis is on how social identity can affect fairness considerations and consequently team efficiency.

C. Social Identity

a. Social Identity Theory: From Psychology to Economics
Bringing the social-psychological concept of identity to economic analysis can convey advantages for the study of group behavior as it can account for many phenomena that standard economics cannot well explain. According to the social identity theory (SIT), developed by Tajfel and Turner (1979), social identity could be defined as a perception of oneness with a group of persons. It has three major components: categorization, identification and comparison. The first is the process of putting others and ourselves into categories, such as gender, ethnicity, profession, age cohort, religious affiliation, sports clubs, etc. As these examples suggest, people may be classified in various categories. A woman can be Asian, a young lawyer, affiliated to some religion, political party and/or be a fan of some sports club. This social classification enables individuals to locate or define themselves in the social environment. Categorization leads to identification, which is the process by which we associate ourselves with certain groups. Finally, identification leads to comparison, which is the process by which we compare our groups with other groups, creating some favoritism towards the group we belong to.

Social identity has been shown to be a central concept in understanding group behavior in social psychology, sociology, anthropology and political science. Management science has also applied the SIT to explain organizational identification. Ashforth el al. (1989) argues that organizational identification is a specific form of social identification as the individuals’ organization may provide an answer to the question: who am I? The SIT literature suggests three general consequences to organizations. Firstly, individuals tend to perform actions consistent with relevant aspects of their identities. Secondly, it affects the outcomes associated with intragroup cohesion, cooperation, fairness, altruism, pride and loyalty to an organization or to its corporate culture. Finally identification may also prompt internalization and adherence to group values and norms and engender homogeneity in attitudes and behavior. In this study we analyze through economic experiments if indeed social identity have these consequences on self-management organizations.

The concept of identity was first introduced in economic literature by Amartya Sen (1985). He considers that the sense of identity can disconnect a person’s choice of actions from the pursuit of self-goal as it can make members to accept certain rules of conduct as part of obligatory behavior towards others in the community. Therefore, a
person’s goal may include objectives other than maximization of his own welfare, as for example social justice.

 Nonetheless, the formal introduction of identity in economic models just starts with Akerlof and Kranton (AK) (2000). They incorporate identity as a motivation for behavior in individual’s utility function. They apply this model to explain economic issues as gender discrimination, poverty, social exclusion and division of labor. In the last decade they extended their analysis to education (2002), organizations (2005) and workgroup (2008).

 In their formulation, identity is based on social categories, $C$. Each person $i$ has an assignment of people to these categories, $c_i$, so that each person has a conception of her own categories and that of all other people. Prescriptions $P$ indicate the behavior appropriate for people in different social categories in different situations. The prescriptions may also describe an ideal for each category in terms of physical characteristics and other attributes. Categories may also have higher or lower social status. They use the word identity to describe both a person’s self-image as well as her assigned categories.

 In Akerlof and Kranton (2000) they propose the following utility function:

$$U_i = U_i(a, a_{-i}, I_i).$$

Utility depends on $i$’s identity or self-image $I_i$, as well as on the usual vectors of $i$’s actions, $a_i$, and others’ actions, $a_{-i}$. Since $a_i$ and $a_{-i}$ determine $i$’s consumption of goods and services, these arguments and $U_i(\cdot)$ are sufficient to capture the standard economics of own actions and externalities. They propose the following representation of $I_i$: $I_i = I_i(a_i, a_{-i}; c_i, \varepsilon_i, P)$.

 In Akerlof and Kranton (2005) they incorporate identity in a principal-agent model where identity works as part of incentives. Their model contrasts with the standard economic model where an individual’s preferences are fixed and utility are not situation dependent. In their framework when an individual enters an organization and adapts its organization culture, he will take actions to fulfill the organizations goals or/norms as he feels like an insider. On the other hand, if he feels like an outsider, he will take actions that are against the organization.

 In this study we use AK formulation to experimentally analyze how social identity conditions fairness and induces individuals to behave according to group prescriptions or norms on fairness.
b. Social Identity Research in Experimental Economics

There are a growing number of economic experiments studying the effects of group identity on behavior and the extent to which ingroup favoritism affects economic outcomes. Using natural social groups in Papua New Guinea, Bernhard et al. (2006) found higher levels of altruism and less punishment towards ingroup members than towards members of other groups. Goette et al. (2006) found higher levels of cooperation in prisoners dilemma games when subjects interact when members of the same platoon of the Swiss Army than when they interact with members of other platoons. In contrast, Charness et al. (2007) do not find significant differences in cooperation in prisoners dilemma or in the battle of sexes games when subjects are matched with members of the same group and when subjects are matched with members of other groups. However, they use minimal group paradigm, where subjects are randomly matched to groups, no interaction is allowed and group membership is anonymous. In our control treatment subjects are also matched randomly and no interaction is allowed. Nonetheless members are heterogeneous and the game is a non-real team effort experiment.

Chen and Li, 2009, present the first study on the effect of identity in social preferences. Their results suggest that in allocation games induced social identity increases altruism and charity concerns towards members of their own group as well as increases the odds that individuals choose social welfare maximizing actions. This study is the one more related to ours, however individual profits are not directly compared as contributions are not observable, we use heterogeneous members and no ingroup/outgroup comparisons.

Considering these theories and previous experimental results, under social identity theory groups should implement the second best sharing rule as it maximizes the total wealth of the team. However, this supposes a great monetary sacrifice from the low ability members. On the other hand, if social identity increases charity concerns, then it may induce high ability members to forego monetary incentives to help the less able people. There is little evidence showing willingness of the poor to sacrifice their economic wellbeing to help the group. One exception is Klor and Shayo (2010) who show that in minimal group experiments poor subjects who are identified with a rich group tend to sacrifice monetary rewards to increase the status of the group. Even so, in their experiment, the rich who sacrifice to help the poor are by far a large majority
when compared to the poor accepting a redistribution that favors the rich for the benefit of the group status.

However, most of experiments on group identity focus on ingroup versus outgroup interactions. One exception is Eckel and Grossman, 2005. They find that induced team identity in a repeated public good game increase cooperation limiting the individual free-riding problem normally observed in team games. However, once again, they focus on homogeneous subjects and use an equal distributional rule given exogenously.

Therefore, the main difference of this article is the study the effect of social identity on heterogeneous teams in terms of redistribution and cooperation. Moreover, our analysis does not focus only on the effects of identity on distribution rules but also on efficiency consideration.

III. Experimental design

The experiment is designed to understand the effect of identity on individual distributional preferences of team members and its impact on productivity. It is based on a two-stage team production model where members vote on the sharing rule in a first stage and simultaneously choose their effort levels in a second stage. We focus our study on teams composed by a majority of high ability members as in these type of teams is expected more unequal sharing rules if all members have the same voting rights. In the following we present the theoretical framework with the precise parameter used in the experimental design. The full model is presented in an appendix for the interested reader. Next a description of the experiment design is presented as well as some discussions of the design.

A. Theoretical framework

Consider a team composed by N=5 input owners (workers) Each member, indexed by i = 1,2,…,5. has an observable skill qi∈ℜ+ and takes an unobservable and unverifiable action ai∈ℜ+ in the production process. Let a = (a1, …, an) ∈ ℜn+; a−i = (a1, …, ai−1, ai+1, …, an); a = (ai, a−i) and q = (q1, …, qn) ∈ ℜn+; q−i = (q1, …, qi−1, qi+1, …, qn); q = (qi, q−i).
The actions of the $N$ individual agents determine a joint monetary outcome according to the production function $F: \mathbb{R}^N_+ \rightarrow \mathbb{R}_+$. $F$ is nondecreasing, continuous, twice differentiable and concave function homogenous of degree $r > 0$. $F$ is exhaustively allocated among members according to a distributional rule $S$. Given that the direct contributions are unobservable, the compensation of member $i$ must be based on the total output. Let $S_i(F)$ stands for agent $i$’s share of outcome $F$. We restrict our attention to linear sharing rules, where a sharing rule is an $n$-tuple of share functions $S=(S_1, \ldots, S_n)$ which satisfies the budget balancing condition: $\sum_{i=1}^n S_i(F) = F$, for all $F \in \mathbb{R}_+$.

Let $F = F(a_1, a_2, \ldots, a_n)$ and $C_i(a_i)$ the private monetary cost of participation in the collective action, strictly convex, twice differentiable and increasing function in $a_i$.

Because in teamwork, the benefit of a members’ action depends on the skill distribution within the team, we assume that total team output is given by:

$$F(a_1, a_2, \ldots, a_5) = \sum_{i=1}^5 k_i(q_1, q_2, \ldots, q_5)a_i \quad \text{and} \quad c_i(a_i) = \frac{a_i^2}{2q_i}$$

Where and $q_i$ is set to represent member’s skills and $k_i$ is a function that aggregates the skills of team members into a measure of the productivity of member $i$. The complementary skills of team members that justify the joint production and give an output from joint production higher than the sum of individual outputs, for the same level of input $a_i$, is captured by the assumption that $k_i$ is increasing in $q_i$, for all $i$, and $k_i(q_1, \ldots, q_N) > k_i(q_{i_1}, \ldots, q_N)$ for any subset $S$ in $N$. $k \geq 1$ for any $i$. Assuming $q_1 > q_2 > \ldots > q_N$, a higher $q_i$ implies a lower cost to manage the same input $a_i$, therefore a higher $q_i$ means $c_1(a_i) < c_2(a_i) < \ldots < c_n(a_i)$.

In this game where $a_i$ is conditional to $S_i(F(a))$, there are multiple possibilities of sharing percentages. In this study we analyze a composed sharing rule, based on Sen (1966), to determine the distributional preferences of heterogeneous team members in terms of equality and equity concerns. Therefore, members can choose a distributional

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2 We follow Hamilton et al (2004) model specifications
3 Let $K = (k_1, \ldots, k_N)$, where $K$ is symmetric in the sense that $k_i(q_1, \ldots, q_N) = k_{\pi(i)}(q_{\pi^{-1}(1)}, \ldots, q_{\pi^{-1}(N)})$ for any permutation $\pi$. Therefore, assuming, without loss of generality, that $q_1 > q_2 > \ldots > q_N$, then $k_1(q_1, \ldots, q_N) \succeq k_2(q_1, \ldots, q_N) \succeq \ldots \succeq k_N(q_1, \ldots, q_N)$. 

rule that range from the equal split and the sharing rule that maximizes the social welfare of the team (U), the second best sharing rule \( (S_i^*) \).

The expected payoff of individual \( i \) is given by the utility function:

\[
U_i = \left( (1 - \alpha)S_i^* + \alpha/5 \right) \sum_k k_i a_i - a_i^2/2q_i, \quad \text{with } \alpha \in [0,1]
\] (1)

Where \( (S_i^*) \) is the second best sharing rule, which is solved backward induction, by maximizing the aggregate of the individual utilities \( U = \sum U_i \) with respect to \( S_i \), taking in account that the effort performed in stage two is dependent of the sharing rule:

\[
\max_{S_i} U(a_1(S_1, ..., S_5), ..., a_5(S_1, ..., S_5)), \quad \text{subject to: } \sum_i S_i^* = 1
\]

\( (\alpha) \) is a parameter that represents the level of egalitarianism of the team.

The distributional rule chosen by the team will therefore depend on the level of egalitarianism of at least a majority of the members of the group. If \( \alpha=0 \) the distributional rule is the second best and if \( \alpha=1 \), the sharing rule is purely egalitarian.

B. Experimental parameters

We design a two-stage non-real effort experiment based on the theoretical framework described above. The production technology and the opportunity cost functions are as described in the previous section with the team production component of the technology, \( k_i(q_1, ..., q_N) \) given by the following expression:

\[
k_i(q_1, ..., q_N) = q_i^{1/2} \left( \prod_{j=1}^N q_j^{-1/2} \right), \quad q_i > 1
\]

Subjects \{1, 2, 3\} are high ability types and subjects \{4, 5\} are low ability types. We fix the values \( q_{high} = 10 \) and \( q_{low} = 5 \) along all the experiment. Subjects vote on the sharing rule in the first stage, majority wins, and in the second stage subjects simultaneously choose an effort level \( a_i \) out of the integer set \( a_i \in \{0, ..., 240\} \).

Although there could be many levels of equalitarianism (\( \alpha \) in equation 1), we select three cases to analyze, which constitute the options presented for voting: total equalitarianism (\( \alpha = 1 \)), total equity (\( \alpha = 0 \)) and a third case where the sharing rule is part egalitarian and part equitable (\( \alpha = 0.5 \)).

Accordingly, under option A, equal sharing, \( S_i = 1/5 \); under option B, what we call median proportional, \( S_{ih} = 0.25 \) for each of the high ability individual and \( S_{il} = 0.125 \) for each low ability one; and under option C, second best shares, \( S_{ih} = 0.30 \) for each of

\[4\] We set this range since the Pareto level of effort for high ability members is 240 (see table 2).
the high ability individual and $S_i^L=0.05$ for each low ability one. Table 1 summarizes the values of the experimental parameters under the assumptions above. Table 2 gives the optimal and equilibrium solutions from wealth maximization (U) and Nash equilibrium solutions (maximization of $U_i$ in equation 1) for each sharing rule.

Table 1: Experimental parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability of high types</td>
<td>10</td>
</tr>
<tr>
<td>Ability of low types</td>
<td>5</td>
</tr>
<tr>
<td>$k$ (value of number) high types</td>
<td>24</td>
</tr>
<tr>
<td>$k$ (value of number) low types</td>
<td>17</td>
</tr>
<tr>
<td>Cost high</td>
<td>$a_i^2/20$</td>
</tr>
<tr>
<td>Cost low</td>
<td>$a_i^2/10$</td>
</tr>
<tr>
<td>Option A</td>
<td>20%</td>
</tr>
<tr>
<td>Option B - high ability</td>
<td>25%</td>
</tr>
<tr>
<td>Option B - low ability</td>
<td>12.5%</td>
</tr>
<tr>
<td>Option C - high ability</td>
<td>30%</td>
</tr>
<tr>
<td>Option C - low ability</td>
<td>5%</td>
</tr>
</tbody>
</table>

Table 2: Experimental predictions

<table>
<thead>
<tr>
<th>Predictions</th>
<th>Equal Sharing</th>
<th>Median Proportional</th>
<th>Second Best</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nash Equilibrium effort</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>48</td>
<td>60</td>
<td>72</td>
</tr>
<tr>
<td>Low</td>
<td>17</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td><strong>Expected payoff</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>692</td>
<td>994</td>
<td>1337</td>
</tr>
<tr>
<td>Low</td>
<td>778</td>
<td>575</td>
<td>265</td>
</tr>
<tr>
<td>Total team profit</td>
<td>3631</td>
<td>4130</td>
<td>4540</td>
</tr>
<tr>
<td><strong>Efficient effort</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team wealth</td>
<td>10085</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C. Experimental treatments and implementation

i) Treatments

As mentioned the experiment is designed to understand the effects of identity on subjects distributional preferences and on team efficiency taking in consideration the setup described previously. Thus, it has two treatments: the voting treatment, where no interaction is allowed. And the identity treatment, where the structure is similar to
the voting treatment but identity is manufactured in a pre-stage and communication allowed in the voting stage. The voting treatment is designed to help us understand the distribution preferences of members when there is no social interaction and serve as a control treatment to compare individual and group behavior under the identity treatment.

To better understand the distributional preferences of members without reputation and reciprocity considerations, we divide the treatments in two settings: the one shot setting, where subjects vote and make decisions on effort in one round; and the 10 rounds setting, where subjects play the vote stage just in the first round and make decisions on effort for 10 rounds with a partner matching.

At the end of each session subjects fulfill a questionnaire where in addition to some demographic questions, they are asked about the level of fairness of the sharing rule decided by the group, their level of group attachment during the experiment and the effect of communication on voting and effort decisions. In the voting treatment we omit from their questionnaire questions related with social identity.

ii) Information conditions

As being a non-real effort experiment expressions like effort and cost of effort are substituted by expressions like number and cost of number and high and low ability types are substituted by type 1 and type 2 subjects. In both treatments the instructions are read aloud. Subjects are told that they will play the game for one round and that they will be randomly matched with four other subjects from the room, the group being composed by three type 1 (high ability) subjects and two type 2 (low ability) subjects. Participants are told that they will be randomly selected to be type 1 or type 2 subjects and that they have to chose a number, which has a cost and a value. Along with the instructions they are given cost tables where they can find the value and the cost correspondent to each of the possible numbers from 0 to 240. Their payoffs are explained as being a proportion of the sum of the values of the numbers chosen by the five members of the group less the individual cost of the number. They are told that this proportion is decided on a first stage, majority rules, from a set of three options (A, B and C) and that if there is a tie the distribution rule will be determined

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5 Instructions for the identity treatment are in appendix C.
6 Cost tables are available upon request.
randomly. After subjects fulfill some comprehension questions the team game starts. At the end of each round, subjects are informed about the sum of the value of the numbers of the group (team revenue) and their individual profit. No information is given about the numbers chosen (effort) by the others members of the group.

### iii) Implementation

In the **voting treatment**, at the beginning of the game, they know which type they are but do not have information about the identity of the other members of the group and no interaction is allowed. In the second stage, subjects discover which of the sharing rules the majority selected and choose the number\(^7\). After the individual profit is displayed on the screen, they are told that the first part of the experiment is over and that their earnings in this part will be added to the gains in the second part. After receiving additional instructions for the second part subjects are randomly selected to be type 1 or type 2 and randomly matched to a different group that stays fixed for the 10 rounds (partner matching). They are told that they will play the same game but the decision number stage is repeated for 10 rounds under the distributional rule decided in the first round.

In the **identity treatment**, after subjects are randomly matched to a group color: Blue, Red, Yellow, Green and Fuchsia, participants observe a screen with eight painting pictures, four identified as being from Picasso and four from Dali. In a following screen, they observe two other pictures from the same artists but not identified, they have to answer which artist painted those pictures. Although the answers are individual, subjects can communicate, through chat, with the members of their group to give the correct answers. They earn a small amount of money for each of the correct answers. To the chat, members are identified by the group color and a number (for example Blue 3) however, they cannot further identify themselves or use inappropriate language. In a second part, they have to choose the sharing rule and can also communicate to decide the best option to vote. As in the voting treatment, they just know what the majority voted, not individual choices. The third part is equal to the voting treatment and they cannot communicate. Subjects play the one shot setting first and the 10 rounds setting afterwards, where they are randomly matched to

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\(^7\) They can use a help screen to make simulation of results for each of the sharing rules in the first stage and for the voted sharing rule in the second stage.
another group color, which stays fix for the 10 rounds; play the pictures stage with
different pictures from the same artists; communicate to vote only in the first round
and make effort decisions for the 10 rounds under the same distributional rule decided
in the voting stage.

i) **Design discussion**

A couple of discussions relative to the experimental design are in order. The first is
related to the process of enhancing group identity in the identity treatment.
Manufacturing group identity in the laboratory is not a straightforward task. For this
reason, we combine several actions, from week to strong identity, that have proved to
produce group effects in previous experiments. Eckel and Grossman (2005) used
several treatment to manufacture identity, between them assignation of subjects to a
group color and participation on a group task before a team game experiment with
face-to-face interaction. Although previous experimental evidence indicates that a
simple assignment of subjects to a certain group by color or painting preferences
produce the same group effects than random assignment, combining this treatment
with a pre-game task with communication has produced strong group effects (Eckel
and Grossman, 2005; Chen and Li, 2009). Therefore, in our experiment firstly,
subjects are randomly matched to five different group colors and secondly, we use the
same pre-game painting task with chat as in Chen and Li (2009). Although face-to-
face treatments could create a higher sense of identity than communication through
chat, it could also lead to many confounding and uncontrolled effects (Roth (1995)),
therefore, we opt for communication through chat. Thirdly, we allow for
communication in the voting stage for ten minutes. Social psychology experiments
have shown that the most effective way for manipulate identity in experiments is by
allowing discussion of the group dilemma (Orbell et al., 1988; Dawes et al., 1986;
1990; Brickman, 1987; Kerr and Kaufman-Gilliland, 1994). Although minimal group
experiments, where subjects have to make decision concerning members of their own
group (ingroup) and/or members from other group (outgroup), have shown that even a
merely random matching induces to ingroup favoritism (Tajtel and Turne, 1979),
Orbell et al., 1988 find that without discussion of the dilemma this effects are
minimal. Furthermore, the analysis of the content of the messages can help us
understand the effects of identity and communication in individual and group behavior. To further evaluate the effects of identity we adapt the Chen and Li (2009) final questionnaire to our setting. This will allow us to understand fairness consideration and to what extent group attachment and discussion of the group dilemma influenced participants’ decisions.

Some comments on the structure of the game are also in order. First we consider that it is important to design the experiment based on economic models that explain team problematic. The most common way to design experiments based on models with interior Nash equilibrium are non-real effort experiments (Nabantian and Schotter, 1997, Irlenbusch and Ruchala, 2008, Sutter, 2006; Sutter and Strassmair, 2009). However, most of these experiments use production functions where the output is given by the sum of efforts and do not consider the theoretical aspect that team production requires complementarities that lead individuals to a higher outcome by working in teams than by working alone. As it could be difficult to replicate effort complementarities in experiments, we opt by use complementary abilities. Being our goal to understand team problematic with heterogeneous agents, we differentiate subjects by given then different abilities. This translates in different values on subjects’ effort, which also replicate the abilities complementarities and in different costs for performing the same level of effort. Some previous experiments in public good games that focus on heterogeneity give subjects different endowments (Buckley and Croson, 2006; Dickinson and Isaac, 1998) and others use different costs of effort (Schotter and Weigelt, 1992; Keser and Montmarquette, 2004). We opt by doing both to be consistent with the team production model. Moreover, accordingly to human capital theory (Becker, 1964; Mincer, 1974) those who have more abilities have lower costs to perform the same level of effort. This theory explains differences in the compensation of workers as a result of differences in their observed ability.

A second comment is related to the composition of the teams. We decide to use groups of five members as if there was an even number of subject, a tie in the voting treatment will be the predicted outcome and if there was only three subjects the one with different ability could feel as an outsider. Although there could be a large range of abilities, for simplicity reasons, we consider two types of subjects, the high and the

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8 Non-real effort experiment allow for control of purely strategic aspects. Real effort experiments can bring the effect of intrinsic motivations that can crowd out the extrinsic motivations (see for example Fehr and Rockenback (2003), Bowles (2005), Fehr and Gachter (2000), Gneezy (2005)).
low abilities. We focus on majority high ability teams as in these type of teams the problematic on output allocation is higher. Some experiments on difference aversion indicate that when subjects are better off there could be a tendency to help those who are worse off (Fehr and Schmidt, 1999; Charness and Rabin, 2002). This could have an impact in our contextualization. To understand this premise, we opt by a majority wins design. This will allows to a better understanding of distributional preferences. Moreover, It will proportionate a better understand on the effects of identity as it allows for anonimatum of those who do not vote for equal sharing. It could also be by consensus or allowing for a bargaining process, but this will implicate a more complex design of the voting stage and the goal of the experiment could be bias.

Another comment is related to the three options for voting. Although the voting options could be just between the equal sharing and the second best, we opt for giving subjects the possibility for a third option that implies a less dispersion in earning when compared to the second best but still takes in account the different abilities. This sharing rule gives part to equality and part according to abilities ($\alpha=0.5$). It also allows testing Sen (1966) theory that subjects could prefer compensation schemes that suppress the need of those less wealthy at the same time that takes in account productivity.

A final comment relates to the discussion of one-shot setting versus the ten-repetition setting. First, the one-shot setting will allow us to study distributional preferences without reputation and reciprocity considerations. On the other hand, a repetition of the contribution stage is important to form a higher degree of group cohesion and allow for “long-term” interaction. Therefore, the one-shot setting and the first round of the ten-rounds setting allow us to compare individual distributional preferences when matched with a group just for one time and when matched for ten rounds.

IV. Hypothesis and Conjectures

The experiment is designed to test the premises of the model. Accordingly to the theoretical prediction, individuals are self-interested and identity should not have an impact on their decisions. However, previous experimental evidence shows that individuals could be affected by social identity. Therefore, we present the null
hypothesis derived from the model for the control treatment and the conjectures on behavior for the identity treatment.

i) Hypotheses: voting treatment

**Hypothesis 1a**: High ability members vote for the second best sharing rule  
**Hypothesis 1b**: Low ability members vote for the equal sharing rule.

According to the theoretical analysis, the dominant strategy for high ability members is to vote for the second best and for the low ability members to vote for the equal split (for prove, see appendix A). Therefore, without social interaction, our hypotheses are that individuals will show self-interest behavior.

Notwithstanding, we acknowledge that in addition to subjects that prefer to implement the distributional rule that make them better off, there could be subjects who have efficiency or equity principles of justice and see equitable to implement the second best sharing rule as it maximizes the total welfare of the team. There could also be subjects who have egalitarianism principles, or in other words, Ralwsian preferences, and see equitable to use an equal sharing rule. Finally, there could be subjects that see equitable to implement a sharing rule that gives part to needs and part to equity.

**Hypotheses 2**: In majority high ability teams, the most voted sharing rule is the second best sharing rule.

Following hypothesis 1a and 1b, in a team where the majority of members are high ability the most voted sharing rule should be the second best.

However, as referred above we acknowledge that there could be heterogeneity on individual distributional preferences. As for example, there could be difference averse high ability individuals who would like to minimize differences in utility and therefore prefer an equal sharing rule; if this is the case, we could observe teams choosing equal sharing rules, even if the majority of high ability members prefer the second best sharing rule.
ii) Conjectures: Identity treatment

Conjecture 1: Identity affects the distributional preferences of members.

Accordingly to the standard economic theory, social identity should not affect members’ distributional preferences. However, accordingly to Akerlof and Kranton (2000) preferences can be changed by the creation and manipulation of the social categories \((C)\) and prescriptions \((P)\). A person \(i\)’s identity \(I_i\) depends, first of all, on \(i\)’s assigned social categories \(C_i\). The social status of a category is given by the function \(I_i(\cdot)\) and a person assigned a category with higher social status may enjoy an enhanced self-image. Identity further depends on the extent to which \(i\)’s own given characteristics \(\varepsilon_i\) match the ideal of \(i\)’s assigned category, indicated by the prescriptions \(P\). Finally, identity depends on the extent to which \(i\)’s own and others’ actions correspond to prescribed behaviour indicated by \(P\).

Therefore individuals can have, for example, equity preferences due to his own characteristics, but they could assigned themselves to a different category due to social interaction with the group and change their preferences towards being egalitarians, if this is the social correct behavior indicated by \(P\) or because they became altruist towards their teammates.

Therefore, we conjecture that identity will change high ability preferences towards being egalitarians as it increases their charity concerns, even if this implies a monetary sacrifice.

Conjecture 2: With identity, in majority high ability teams, the most voted sharing rule is the equal sharing.

Following conjecture 1, opposite to the voting treatment, in the identity treatment we conjecture that an equal sharing rule group norm \((P)\) will emerge which will induce to a majority of the high ability members to choose an equal split.

Conjecture 3a: Identity increases effort levels of high skilled players.
Conjecture 3b: Identity increases effort levels of low skilled players.
According to the theoretical prediction manufacturing identity should not influence effort decisions. However, there is previous experimental evidence indicating that identity increases the effort level of team members (Eckel and Grossman, 2005) and promotes social welfare-maximizing actions in favor of self-interest actions (Chen and Li, 2009). Moreover, economic theory has shown that communication increases cooperation (Farrel, 1995; Crawford, 1998; Blume and Ortman, 2007). Although these studies consider identical members and equal split, we conjecture, that in our setting both types of players will increase their levels of contributions as it is the right thing to do in favor of the team benefit.

**Conjecture 4**: Identity increases team efficiency.

As we conjecture that identity increase effort levels (conjecture 3a and 3b) it should also increase efficiency. However, we also predict that it will lead to more equal compensation schemes (conjecture 2). Therefore, we conjecture that contribution of members will increase to a threshold that suppresses the efficiency damage that arises with the equal sharing rule.

I. **Results**

A total of 100 subjects were recruited from undergraduate courses in several disciplines (economics, literature, business, sociology, etc) by Orsee recruitment software at Universitat Autonoma de Barcelona. The experiment was designed in Z-tree software and lasted around 2 hours on average. All subjects received a 5€ participation fee and earn, on average, 14€ per subject. We conducted four sessions: one session per treatment in June 2011, and repeated both sessions on November 2011. We collected a total of 80 independent observations per group, which is the base of our statistical analysis.

We first present the voting results analyzing the effect of identity in distributional preferences and then we analyze the effect of these voting decisions of effort supply and team efficiency. Following communication analysis is presented. Robustness checks and post-experimental questionnaire analysis are given at the end of the section.
A. Voting results

In this session we analyze the voting decisions of team members. Recall that participants could vote on option A, equal sharing; option B, median proportional or on option C, second best compensation scheme. Each subject voted twice in each session, in the one shot setting and in the first round of the 10 rounds setting. We do not find significant differences on voting decisions between the two settings (U-test \(p=0.8474)\). Figure 1 shows the voting decisions per type and treatment. It can be seen that in the voting treatment sixty percent of the high ability players vote for the option C, thirty three percent voted in the equal share (being 75 percent females) and seven percent voted in the median share; eighty five percent of the low ability participants vote for the equal sharing rule, thirteen percent voted in the median share (being all males) and two percent voted in the second best.

![Vote Results](image)

**Figure 1. Percentage of votes by treatment and type**

Therefore, we observe that subjects make their decisions according to their dominant strategy. While the majority of high ability members vote for the proportional sharing rule (binomial test \(\alpha=0.5, p=0.077)\), the majority of low ability

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9 We use both settings in the results’ report.
10 By using the binominal test (one-tailed) we state the level of significance at which the null hypothesis that in the majority of the times subjects vote for the compensation scheme that lead them to better outcomes can be rejected.
members vote for the equal sharing rule (binomial test $\alpha=0.5$, $p=0.000$). We cannot reject hypothesis 1a or 1b that members prefer the compensation scheme that gives them better payoffs.

**Observation 1:** In heterogeneous teams where members have equal rights to decide the compensation scheme, their individual distributional preferences are mainly for the sharing rule that gives them better monetary payoffs.

![Figure 2: Group vote results](image)

In the **identity treatment** we observe a significant difference in the voting decisions of high ability members in comparison to the voting treatment (Mann-Whitney test, $p=0.0003$). We find that the percentage of votes in equal share increase from 33 percent in the voting treatment to 67 percent on the identity treatment. Therefore, our conjecture that identity affects subjects’ distributional preferences and increases the charity concerns of high ability members is confirmed. However, we do not find a significant effect of identity on low ability distributional preferences (Mann-Whitney test, $p=0.2915$). Therefore, we can only partial confirm conjecture 1.
In the voting treatment the proportion of self-maximizers\textsuperscript{11} is seventy percent while the egalitarians\textsuperscript{12} are just twenty percent. With identity the percentage of self-maximizers decreased by 29 percent (U-test, p=0.0040) and the percentage of egalitarians increased 50 percent (U-test, p=0.0021).

**Observation 2:** Identity affects high ability distributional preferences but does not have an effect on low abilities.

Figure 2 summarizes the voting results per groups. Interestingly, in the voting treatment, the most voted sharing rule was the equal sharing with 11 out of 20 groups (55%) voting for it. There were 3 groups (15%) where the median share was chosen to be the distributional rule (being determined randomly in two of them due to a tie) and there were 6 groups (30%) were the majority voted the proportional sharing rule. We can reject hypothesis 2 that in teams mostly composed by high ability members, the most voted sharing rule is the second best (binomial test, $\alpha=0.5$, p= 0.058).

With identity, about 77 percent of the participants voted in the equal sharing, 13 percent voted in the proportional share and 10 percent voted in median share. Consequently, there was a significant increase of groups using equal compensation schemes (90 percent) (Mann-Whitney test, p=0.000). The percentage of groups that decide to perform under the second best distribution rule decreases by 100 percent (Mann-Whitney test, p=0.000) as the group performed under this compensation scheme was decided randomly due to a tie in the one shot setting. We can therefore confirm our conjecture 2 that with identity, in majority high ability teams, the most voted sharing rule is the equal sharing.

**Observation 3:** Without social interaction, in majority high ability teams, a low majority of groups (55%) decide to use equal sharing rules. With identity almost all group (90%) decide to perform under an equal distribution rule. Therefore, team identity is a plausible explanation for the use of equal distributions in heterogeneous self-managed teams.

\textsuperscript{11} Subjects that choose the sharing rule that lead them to a better payoff.

\textsuperscript{12} High abilities that vote for equal sharing even decreasing their own economic wellbeing.
Figure 3 shows how groups reach the decision on the distributional rule. We can see that in the voting treatment the majority of groups reach a decision by low majority (3 members) and that reaching a consensus is quite rare. In the identity treatment we observe a decrease of decisions by a low majority and a significant increase on consensus (Mann-Whitney test, p=0.000 for both). The decisions by high majority (4 members) and the ties do not differ significantly by treatment (Mann-Whitney test, p=0.4296; p= 0.1806 respectively). Therefore, We can infer that with identity heterogeneous groups reach higher levels of consensus when deciding the distribution rule. Interestingly, these consensuses were mainly for voting in the equal split.

**Observation 4:** Team identity with communication increases the level of consensus in the chosen sharing rule.

**B. Effort levels**

In this session we present the effect that the voting decisions have on actual contributions. As the majority of high ability members have self-maximizations preferences on the voting treatment how will they react when is imposed an equal split by the majority of the group? On the other hand, identity induces high ability
subjects to choose more equal sharing rules, but what is its effect on effort decisions of the different types of members?

Figure 4a shows the average contribution for each treatment. It can be seen that identity slightly increase effort decisions, however not significantly (Man-Whitney test, p=0.1736). Consequently, we do not find differences in individual profit (Utest, p=0.4497) or in the total team revenue (Utest, p=0.9988). Figure 4b shows contribution by type of subjects, we can observe no significant differences in contribution levels of high ability members (Utest, p=0.6501), however, identity increases effort levels of low ability members (Utest, p= 0.0025). Therefore, we cannot confirm our conjecture 3a but can confirm our conjecture 3b. Moreover we fail to confirm our conjecture 4 that identity increase team efficiency.

**Observation 5:** Team identity does not increase effort levels of high ability members in teams whit a heterogeneous composition, but increases contribution of low ability types.

This is a surprising result as in previous experimental evidence with identical members identity increases cooperation (Eckel and Grossman, 2005). As we observed in the previous section, there is a heterogeneity in the sharing rules decided by the group is each treatment. To study more in deep effort decision, we next analyze it by the different sharing rules.

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13 The data used to effort analysis is the ten rounds setting. Although we do not find statistical differences between the one-shot setting and the first round on the ten rounds setting in any of the analysis presented here, we consider more accurate to present the results referent only to the ten rounds setting.
Table 6a: Effort by Sharing Rule: Prediction comparison

<table>
<thead>
<tr>
<th></th>
<th>Average effort</th>
<th>Average payoff</th>
<th>Average team profit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equal SR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High members</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voting treat</td>
<td>77*** (48)</td>
<td>839** (692)</td>
<td>4804*** (3631)</td>
</tr>
<tr>
<td>Identity treat</td>
<td>71***</td>
<td>934***</td>
<td>4743***</td>
</tr>
<tr>
<td>Low members</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voting treat</td>
<td>33*** (17)</td>
<td>1143***</td>
<td>778</td>
</tr>
<tr>
<td>Identity treat</td>
<td>45***</td>
<td>970**</td>
<td></td>
</tr>
<tr>
<td><strong>Median SR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High members</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voting treat</td>
<td>92** (60)</td>
<td>1367*** (994)</td>
<td>5572*** (4130)</td>
</tr>
<tr>
<td>Identity treat</td>
<td>235***</td>
<td>1760***</td>
<td>9454***</td>
</tr>
<tr>
<td>Low members</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voting treat</td>
<td>39*** (11)</td>
<td>735*</td>
<td></td>
</tr>
<tr>
<td>Identity treat</td>
<td>35***</td>
<td>2089***</td>
<td></td>
</tr>
<tr>
<td><strong>Second best SR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High members</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voting treat</td>
<td>114 (72)</td>
<td>1665*** (1337)</td>
<td>5656 (4540)</td>
</tr>
<tr>
<td>Identity treat</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Low members</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voting treat</td>
<td>18*** (4)</td>
<td>330</td>
<td>(265)</td>
</tr>
<tr>
<td>Identity treat</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
</tr>
</tbody>
</table>

*** significant above the equilibrium value at the 1 percent level (p ≤ 0.01)
**  significant above the equilibrium value at the 5 percent level (0.01 ≤ p ≤ 0.05)
*   significant above the equilibrium value at the 10 percent level (0.05 ≤ p < 0.10)

Table 6 summarizes average effort, average payoff and average team profit by types of subjects and sharing rules for the different treatments. First, we compare the effort exerted in each of the sharing rule in each treatment with predicted equilibrium effort\textsuperscript{14}. We can observe that in the majority of times both high and low ability members exert an effort higher than predicted in all the sharing rules on both treatments. Consequently we observe an individual profit and total team revenue also higher than predicted. Exception is the case of the effort exerted by the high ability members in the second best sharing share, which is not more often above the

\textsuperscript{14} By using the binomial test (one-tailed) we state the level of significance at which the contributions are more often above the equilibrium level than below. (see table 2 for predictions).
predicted value than below. This leads to an individual profit of the low ability members and a total team revenue akin to the predicted level.

Second, we do a within and between treatment analysis. In the voting treatment we can observe that higher the share high ability members receive, higher their effort level: Effort equal< Effort median< Effort second best (Wilcoxon text p=0.0099; p=0.329, respectively). However, the low ability members exert a higher effort in the median proportional than in the equal sharing (Wilcoxon text p= 0.0367). This result could be explained by the fact that in the voting treatment the median proportional was decided randomly due to a tie in some groups. As expected they perform a lower effort under the second best share (Wilcoxon text p=0.0001). In terms of individual payoff, the results follow the predicted pattern: for high ability types: Profit equal< Profit median< Profit second best (Wilcoxon text p=0.0051; p=0.0051 respectively); for low ability types: Profit equal> Profit median> Profit second best (Wilcoxon text p=0.0051; p=0.0051 respectively). In what concerns the total team revenue, we do not find a significant difference in team efficiency when they operate under a median proportional or the second best (Wilcoxon text p=0.4446), however we find that teams reach a higher efficiency with the median or the second best sharing rule than with the equal split (Wilcoxon text p=0.0069). This result confirms the findings of Marreiros (2010) that with exogenous sharing rules teams reach higher levels of efficiency when performing under the second best sharing rule than under equal compensation schemes.

Our conjecture was that identity would increase effort levels of both types of players in all the sharing rules. However, we find that identity can also have a reverse effect on members’ effort. We can observe that with identity and an equal sharing rule the high ability members decrease their effort levels, although not significantly (Man-Whitney test p= 0.4057) while low ability members increase it significantly (Man-Whitney test p= 0.0126). Whit a median proportional the reverse happens, high ability members significantly increase their effort levels (Man-Whitney test p=0.0001) while the low ability members decrease it, although not significantly (Man-Whitney test p= 0.4487).

These results have an interesting effect on individual payoffs. We can observe that under the equal split, while the high ability members increase their individual payoff with identity (Man-Whitney test p=0.0284), the low abilities decrease it (Man-
Whitney test p=0.0413). Under the median sharing rule both types of players increase their profit with identity (Man-Whitney test p=0.0002 for both type of players).

![Figure 5a: Average payoff under equal sharing in the voting treatment](image)

![Figure 5b: Average payoff under equal sharing in the identity treatment](image)

While figure 5a shows that in the voting treatment and an equal sharing rule the low ability members receive a higher individual payoff than their high ability team mates (Wilcoxon test p= 0.0051), figure 5b shows that in the identity treatment the profit of high and low abilities are not significant different (Wilcoxon test p= 0.5751). Therefore, under an equal sharing rule, identity decrease dispersion on efforts and on individual payoffs (Mann Whitney test, p=0.0064; p=0.0197 respectively).

In what efficiency is concerned, we do not find that identity increases team efficiency under an equal sharing rule (Mann Whitney test, p=0.5453) but we do find a significant effect of identity when teams operate under the median proportional (Mann Whitney test, p=0.0002). Although, significantly different from the Pareto optimum (Wilcoxon p=0.0051). Observing figure 6 we can see that under this sharing rule teams could reach agreements that lead to an efficiency close to the first best. This effect could result of pacts made in the voting stage. We analyze this fact in the communication analysis presented next.

**Observation 6:** Under an equal sharing rule, identity does not increase team efficiency but equalizes individual profits. Under a sharing rule that weighs equal sharing and wealth maximization criteria, identity highly increases team efficiency, however, just a few groups chose this rule.
As identity lead to the majority of the group deciding for an equal compensation scheme but not all members vote for it, we next analyze individuals behavior when they vote for the sharing rule that end up being the distributional rule decided by the group and when they did not.

Table 7 shows the average effort by treatment, analyzing differences according to members’ individual voting decisions. The first two columns give the average effort without distinguishes per vote decisions. The columns three to eight give the average effort according to subjects voting decisions and column nine reports average effort when members do not have the option for voting (Marreiros 2010).

We first analyze subjects’ behavior when the distribution rule decided by the group was the equal sharing. As expected, when low ability members vote for it, identity increase effort level of the low ability members when compared to the voting treatment (Mann-Whitney test: p=0.0527). However, surprisingly, we can observe that identity has a negative effect on high ability members’ effort levels. When they decide to vote for the equal sharing and this is the sharing rule decide by the group, identity decrease contributions when compared to the voting treatment (Mann-Whitney test, p= 0.0821). We conjecture that this happens because, as referred previously, the main effect of identity in heterogeneous teams is that it equalizes individual payoffs. Nonetheless, the most surprising result is the low contribution of

Figure 6 – Total tem revenue (UT) by sharing rule.
high ability members when they vote for the second best and the group decide for the equal share, which is significant lower than when members vote for the equal share in both the voting and the identity treatment (Wilcoxon test p= 0.0049; p= 0.0051, respectively). Moreover, as we can observe in columns 7 and 8, with identity their effort is significant lower than in the voting treatment (Mann-Whitney test, p= 0.0113).

Table 7: Average effort by type, treatment and vote decisions

<table>
<thead>
<tr>
<th></th>
<th>Average effort</th>
<th>Marreiros (2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(vote=equal)</td>
<td>(vote=median)</td>
</tr>
<tr>
<td><strong>VOT</strong></td>
<td>(vote=equal)</td>
<td>(vote=median)</td>
</tr>
<tr>
<td>Equal sharing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High members</td>
<td>77</td>
<td>86*</td>
</tr>
<tr>
<td>Low members</td>
<td>33**</td>
<td>35*</td>
</tr>
<tr>
<td>Median sharing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High members</td>
<td>92***</td>
<td>78</td>
</tr>
<tr>
<td>Low members</td>
<td>39</td>
<td>31***</td>
</tr>
<tr>
<td>Second best</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High members</td>
<td>114</td>
<td>114</td>
</tr>
<tr>
<td>Low members</td>
<td>18</td>
<td>21</td>
</tr>
</tbody>
</table>

We can also observe the negative effect that voting in one sharing rule and end up performing under another has on effort decisions of low ability members. Those who vote for the equal share but the group decided for the median proportional perform significant lower than those who vote for the median share in both treatments (Wilcoxon test, p=0.0049 for both treatment). Moreover, they perform worse with identity than without social interaction when they vote for the equal share and the group decided for the median share (Mann-Whitney test: vote equal: p=0.0001).

While the fact that members perform better when the group decide for the sharing rule they vote for than when the group does not is a novel but not a surprising result, the phenomena that identity accentuate this discrepancy is quite interesting. We conjecture that with identity the members who vote differently from the majority of
the group feel as outsiders of the group. Akerlof and Kranton (2005) consider that when members feel as outsiders they get utility by performing actions that go against the group goal. These results confirm this theory, however, are contrary to previous experimental evidence that identity decreases envy (Chen and Li, 2009).

**Observation 7:** Team members that vote the same as the majority of the group perform better than those who vote differently. Identity intensifies this phenomenon, decreasing highly the contributions of those who vote differently, as they feel as outsiders of the group.

Considering this negative effect of performing under a sharing rule that does not correspond to the one subjects vote for, we compare effort levels of the voting treatment with effort levels from Marreiros (2010) data, where subjects performed under an equal share and a second best, but the sharing rule was given exogenously. We find no difference in high ability effort levels when they are given the option of voting to when the sharing rule is given exogenously (Wilcoxon test, equal sharing: p=0.9594; second best: p=0.6465). When performing under the equal sharing rule, the low ability members are more sensitive to the voting options, however, surprisingly, in a negative way, as they perform a higher effort when the sharing rule is given exogenously than when they have the option of voting for it (Wilcoxon test, p=0.0284). When performing under the second best, we find no differences in effort levels (Wilcoxon test, p=0.1688).
C. Communication Analysis

We have seen that identity has a strong effect on the distributional preferences of high ability participants but not an effect on their effort decisions; in contrast, it has a positive effect on the performance of low abilities but no effect on their sharing preferences. In this session we analyze the contents of the communication to better understand what drive these results.

Recall that in the identity treatment, in addition to the pictures stage, where subjects could freely chat to perform a simple task before the dilemma starts, subjects could discuss the distributional rule options through the chat in the voting stage.

To the communication analysis of the pictures stage, we assign the value of “one” if subjects participates have an active participation on the chat and “zero” otherwise. We find that 93 percent of the subjects participate in conversations about the paintings from which 10 percent engaged in friendly talk (not related to the pictures) after discussing the painting authors. Moreover, we count the number of messages sent by each subject to understand if the amount of communication on this stage have an impact on their decisions in later stages.\[15\]

To the communication analysis of the voting stage, we developed and implemented a coding scheme for the messages content parallel to those implemented by Brandts and Cooper (2007) and Sutter and Strassmair (2009). To analyze the messages we developed 12 categories for the different types of statements and agreements as follows: First we establish a preliminary set of categories based on the conjectures presented and prior research. After reading a sample of the chat we added other categories that appeared to be relevant. Subsequently, one research assistant independently coded the chat, assigning the value of “one” if the message contained statements or arguments relative to a category and “zero” otherwise. The only information given to the coder was the instructions for the experiment, therefore he just had the information that participants on the experiment had. Finally the categories were then reconciled.

\[15\] we then use this dummy variables in the regression analysis on voting decisions.
In addition, we analyze if the group actually agreed on the sharing rule; if the group made a pact on which numbers they should choose in the following stage and if the group engage in friendly talk outside the dilemma\(^{16}\).

Table 8 lists the categories for coding, their description, the relative frequency that a category was coded as present (value=1) and the percentage of subjects that participate in conversations of the category (discriminated by type). The proposal to choose equal shares (C1); proposals to make agreements on the numbers to choose in the next stage (C10) and proposals on which numbers to choose (C11) were, by far, the most frequent categories. In the category of proposing equal shares (C1), about 15 percent of cases were proposals and 16 percent were agreements. This category was discussed in all the groups, where 77 percent of the subjects participated on it. About 65 percent of the low ability players and 43 percent of high ability participants propose the use of this distributional rule by the group. Nonetheless, we find that just in 55 percent of the cases the first member that proposes equal shares was a low ability participant, being a high ability subject that first makes this proposal in the remaining 45 percent of the cases. The proposals of equal sharing were backed up by arguments appealing to fairness (C4), equity (C5), not hurt the low abilities subjects (C6) and arguments that the equal sharing is the one that benefit all (C7). Proposals of second best (present in 15 percent of the groups) and median share (present in 25 percent of the groups) made by high abilities, were contradict by low abilities with arguments appealing to fairness (C4), not to be selfish (C9) and not to hurt low ability subjects (C7). In 75 percent of the groups an agreement on the distributional rule was reached, which justifies the increase of consensus. About 80 percent of the high abilities that participate in category C1, by proposing or agreeing with it, actually vote on the equal share.

We can see that 27 percent of the subjects propose to make a pact on numbers (C10), however, just 23 percent of subjects participate in conversations about reaching an agreement on the numbers to choose in the following stage (C11). Although 50 percent of the groups engage in these type of conversations (C11), just 25 percent of groups reach an agreement. About 60 percent of these groups comply with it. However, in 50 percent of those group subjects decrease their effort levels after the second period as not all members maintain the pacted level of effort.

---

\(^{16}\) The coder was also asked to check for these group decisions.
Table 8: Categories for coding messages

<table>
<thead>
<tr>
<th>Categories</th>
<th>Relative frequency 17 Code “1”</th>
<th>Percentage of subjects participating in category 18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type1</td>
<td>Type2</td>
</tr>
<tr>
<td>C1 Proposal equal shares (Option A)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agreement</td>
<td>15%</td>
<td>43%</td>
</tr>
<tr>
<td>C2 Proposal second best share (Option C)</td>
<td>2%</td>
<td>10%</td>
</tr>
<tr>
<td>Agreement</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>C3 Proposal of median share (Option B)</td>
<td>2%</td>
<td>7%</td>
</tr>
<tr>
<td>Agreement</td>
<td>1%</td>
<td>3%</td>
</tr>
<tr>
<td>C4 Appeal to fairness</td>
<td>6%</td>
<td>13%</td>
</tr>
<tr>
<td>C5 Appeal to equity</td>
<td>3%</td>
<td>13%</td>
</tr>
<tr>
<td>C6 Appeal to not hurt low ability members</td>
<td>3%</td>
<td>8%</td>
</tr>
<tr>
<td>C7 Appeal to the benefit of all members</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>C8 Refer to majority of high abilities</td>
<td>3%</td>
<td>17%</td>
</tr>
<tr>
<td>C9 Refer to selfish preferences</td>
<td>4%</td>
<td>13%</td>
</tr>
<tr>
<td>C10 Proposal to pact on numbers</td>
<td>12%</td>
<td>28%</td>
</tr>
<tr>
<td>Agreement</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>C11 Proposal of numbers</td>
<td>13%</td>
<td>18%</td>
</tr>
<tr>
<td>Agreement</td>
<td>8%</td>
<td>3%</td>
</tr>
<tr>
<td>C12 Appeal to commitment</td>
<td>1%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Group level (% of groups)

| Group agree on Sharing Rule | 75% |
| Group pact Numbers          | 25% |
| Group engage in friendly talk | 10% |

D. Robustness checks

i) Robustness checks: Voting decisions

In this section, we analyze the determinates of voting on equal shares using regression analysis. The results essentially corroborate those obtained with the non-parametric tests reported previously and allow us to control for subjects’ demographic characteristic and communication categories on the identity treatment.

Table 9 presents the logit regression. In the first model (all treatments) we can observe that in the identity treatment the odds of voting on the equal share increase as

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17 The relative frequency of the categories is calculated dividing the number of times that the category was coded “1” from the total of messages coded as “1”, which were 431 in total.

18 In subjects analysis, we coded as “1” if the subject participated in the category and “0” if he didn’t. Thus, column 3 (4) refers to the percentage of high abilities (low abilities) that participate in each category.
seen by the significant coefficient for the “Treatment” dummy. This is consistent with our non-parametric results and adds support to our conjecture that identity changes the distributional preferences of members. Low ability types are more prone to vote on equal shares than high ability types in both treatments as we can seen by the significant and negative coefficient for the “Type” dummy in model (1), (2) and (3). We can also see that there is a significant effect of gender on equality preferences. We can observe that being female increase the odds of voting equal, as observed by the significant and positive coefficient on “Gender” dummy in all the models. There is no effect on the interaction gender and type (Gender*Type in model (1)), meaning that females vote more for equal shares independently of being high or low ability type. We can also see that studying economics or business have a negative effect on choosing equal shares (Career). This is not an unusual result in experiments, as these students are used to calculate optimal results. The significance of this variable disappears on the voting treatment (model 2). Analyzing the identity treatment (model 3) we can see that the effect of type, gender and career is the same as in the voting treatment, but age has now an effect. Older students tend to choose more equal shares. We can also observe that higher the number of messages sent by subjects on the pictures stage higher the tendency to choose equal shares (Num MSG Picture). Also, participate on conversations about voting on equal shares (category C1) increase the probability of voting equal. The same effect happens on the category C2, which refers to proposals of voting on second best shares. We conjecture that this contradictory effect is observed because some of the few subjects that propose this sharing rule were convinced by the others to vote equal. Except for the appeal to commitment category dummy (C12), which increase the odds of voting equal, none of the other categories that were used to backup arguments on voting options have a significant effect.²⁰ The fact that the group reaches an agreement on the distributional rule also increases the probability of voting on equal shares. However, agreeing on the numbers for the next stage has a negative effect of voting equal. This could be justified by the fact that some groups that agree on the numbers decide to vote on the median sharing rule.

²⁰²⁰ In this analysis we use the data of the one-shot setting and the first round of the ten rounds setting. We perform the same regressions using panel data and the results are similar.

²⁰²⁰ Some of the categories that refer to the same type of arguments were added in the regressions analysis.
Table 9: Logit regression: determinants on voting equal

<table>
<thead>
<tr>
<th></th>
<th>All treatments (1)</th>
<th>Voting treatment (2)</th>
<th>Identity treatment (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1.835*** (0.498)</td>
<td>-3.006*** (0.607)</td>
<td>-8.040*** (2.328)</td>
</tr>
<tr>
<td>Type</td>
<td>-3.061*** (0.522)</td>
<td>-3.006*** (0.607)</td>
<td>-8.040*** (2.328)</td>
</tr>
<tr>
<td>Age</td>
<td>0.015 (0.051)</td>
<td>-0.025 (0.058)</td>
<td>0.800*** (0.260)</td>
</tr>
<tr>
<td>Gender</td>
<td>1.385*** (0.464)</td>
<td>1.907*** (0.601)</td>
<td>2.750*** (0.682)</td>
</tr>
<tr>
<td>Career</td>
<td>-1.107*** (0.452)</td>
<td>-0.590 (0.718)</td>
<td>-5.317*** (1.644)</td>
</tr>
<tr>
<td>Career year</td>
<td>0.079 (0.136)</td>
<td>0.246 (0.229)</td>
<td>0.038 (0.413)</td>
</tr>
<tr>
<td>Session</td>
<td>0.106 (0.592)</td>
<td>-0.699 (0.761)</td>
<td>-0.308 (1.111)</td>
</tr>
<tr>
<td>Period</td>
<td>-0.058 (0.438)</td>
<td>-0.096 (0.461)</td>
<td>3.447* (1.486)</td>
</tr>
<tr>
<td>Gender*Type</td>
<td>0.657 (0.552)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Num MSG Picture</td>
<td>0.136*** (0.050)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>5.321*** (1.600)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>5.848* (3.026)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>-1.891 (1.641)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>-1.477 (1.094)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>-1.034 (1.166)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C6+C7</td>
<td>-1.693 (1.691)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C8+C9</td>
<td>2.736 (1.454)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C10+C11</td>
<td>2.935 (1.838)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C12</td>
<td>4.879** (2.076)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group agree SR</td>
<td>7.180*** (1.787)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group agree Num</td>
<td>-8.841*** (2.863)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cons</td>
<td>-5.060*** (1.354)</td>
<td>-4.460*** (1.641)</td>
<td>-21.673*** (6.568)</td>
</tr>
<tr>
<td>Number of Obs</td>
<td>196</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>Prob &gt; chi2</td>
<td>0.000</td>
<td>0.0001</td>
<td>0.000</td>
</tr>
<tr>
<td>Pseudo R2</td>
<td>0.289</td>
<td>0.3227</td>
<td>0.6181</td>
</tr>
</tbody>
</table>

Standard errors are in parenthesis. ***, ** and * indicate significance at p=0.01, p=0.05 and p=0.10, respectively. Dependent variable: Vote Equal=1 if subjects voted equal and Vote Equal=0 otherwise. Independent variables: Treatment=0 for the voting treatment and Treatment=1 for the identity treatment; Type=1 for the high ability subjects and Type=0 for the low abilities; Gender=1 for females and Gender=0 for males; Career=1 if subjects study economics or business, Career=0 otherwise; Session=0 for the first sessions performed and Session=1 for the second sessions; Period=0 for the one shot setting and Period=1 for the first round of the ten rounds setting.

ii) Robustness checks: Effort

In this section, we analyze the determinates of effort decisions using regression analysis. The results essentially corroborate those obtained with the non-parametric tests reported previously and allow us to control for subjects’ demographic characteristic.

In table 10 we report the estimation results of a panel data general least squares with random effects at the subject level. We regress the individual effort on voting...
decisions, using dummy variables (vote equal; vote median and vote proportional); a
dummy to represent identity treatment (treatment); a dummy for high ability players
(type); a dummy to represent if the decisions were made by the majority of members
of if there was a tie (Majority); dummies for the sharing rule decided by the group
(SR_equal; SR_median; SR_proportional) and a dummy representing if members use

the help screen or not (Help). Moreover we use the information that members enter on
the help screen as a proxy for the beliefs members have on others level of effort

Table 10: Panel data regression on effort decisions – GLS

<table>
<thead>
<tr>
<th>Effort</th>
<th>Overall (1)</th>
<th>Equal share (2)</th>
<th>Equal share High abilities (3)</th>
<th>Equal share Low abilities (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vote Sec_best</td>
<td>1.92</td>
<td>-13.96**</td>
<td>-14.93**</td>
<td>-29.99**</td>
</tr>
<tr>
<td>Vote Median</td>
<td>18.01**</td>
<td>-43.07***</td>
<td>-24.10*</td>
<td>-14.38</td>
</tr>
<tr>
<td>Treatment</td>
<td>23.65***</td>
<td>13.43***</td>
<td>2.26</td>
<td>27.76***</td>
</tr>
<tr>
<td>Type</td>
<td>51.12***</td>
<td>36.52***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Majority_1</td>
<td>15.62***</td>
<td>18.16***</td>
<td>10.28</td>
<td>14.10**</td>
</tr>
<tr>
<td>SR_Equal</td>
<td>-42.03***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SR_Median</td>
<td>15.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.73*</td>
<td>1.87***</td>
<td>3.32***</td>
<td>-0.86</td>
</tr>
<tr>
<td>Gender</td>
<td>16.03***</td>
<td>19.22***</td>
<td>28.59***</td>
<td>11.88**</td>
</tr>
<tr>
<td>Num siblings</td>
<td>-5.67***</td>
<td>-0.01</td>
<td>-1.41</td>
<td>-0.74</td>
</tr>
<tr>
<td>Career</td>
<td>9.23**</td>
<td>19.11***</td>
<td>9.49*</td>
<td>8.31</td>
</tr>
<tr>
<td>Career year</td>
<td>1.87</td>
<td>1.64</td>
<td>-1.89</td>
<td>2.80</td>
</tr>
<tr>
<td>Help</td>
<td>-24.25***</td>
<td>-20.43***</td>
<td>-25.84***</td>
<td>-12.24</td>
</tr>
<tr>
<td>beliefs_eff_Hig</td>
<td>0.10**</td>
<td>0.15***</td>
<td>0.29***</td>
<td>-0.05</td>
</tr>
<tr>
<td>beliefs_eff_Low</td>
<td>0.13</td>
<td>0.02</td>
<td>-0.18</td>
<td>0.16***</td>
</tr>
<tr>
<td>session</td>
<td>0.88</td>
<td>7.26***</td>
<td>19.32***</td>
<td>0.83</td>
</tr>
<tr>
<td>Period</td>
<td>-5.46***</td>
<td>-4.93***</td>
<td>-5.96***</td>
<td>-2.36</td>
</tr>
<tr>
<td>cons</td>
<td>28.57*</td>
<td>-50.94***</td>
<td>3.12</td>
<td>-3.50</td>
</tr>
<tr>
<td>Period dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Group dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of obs</td>
<td>980</td>
<td>680</td>
<td>420</td>
<td>260</td>
</tr>
<tr>
<td>Subjects</td>
<td>25</td>
<td>25</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>R-sq (overall)</td>
<td>0.3655</td>
<td>0.3743</td>
<td>0.4942</td>
<td>0.4088</td>
</tr>
<tr>
<td>Prob &gt; chi2</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Standard errors are in parenthesis. ***, ** and * indicate significance at p=0.01, p=0.05 and p=0.10, respectively.
(beliefs_eff_t1 and beliefs_eff_t2). We control also for age; gender; number of siblings; career (if studying economics or not) and career year. We control for session and include period and group dummies in all models. In model 1 we include all the data, in model 2 we analyze effort decision under the equal sharing rule, in model 3 we focus on the high abilities level of effort under an equal sharing and in model 4 we center our focus on low abilities level of effort under an equal sharing.

The general model (1) indicates that the effort performed by those that vote on the second best does not differ from the effort of those that vote on the equal share. In contrasts those who vote on the median share perform a significant higher effort than those who vote on the equal share. We observe that identity has a positive effect on effort decisions, as observed by the significant coefficient of “Treatment” variable. This result clearly confirms our conjecture that identity increase effort levels.

Confirming the non-parametric results, we observe that high ability types exert a higher effort than their low ability teammates. How the distributional rule was decided has also an impact on effort level, we observe that when it was decided by majority (three, four or five members) subjects performed a higher effort than when there was a tie and the sharing rule was decided randomly. We also find that using the help screen decreases the effort level. Moreover, we find that the higher the effort they belief the other high ability members will do (beliefs_eff_High), higher their own effort, however we find no effect on the beliefs of the effort that low ability partners could exert (beliefs_eff_Low). In relation to the demographic characteristics, we find that females and economics students tend to exert higher effort, in contrast, higher the number of siblings, lower the effort.

Most importantly, and corroborating our non-parametric results, we find that when there is an equal division of total profit the effort level is significant lower than when the distributional rule is the second best (SR_Equal). No significant differences between the median share and the second best (SR_Median).

Considering this result we regress effort level when the distributional rule was the equal share (model 2). We find that, although effort is higher in the identity treatment, those who do not vote in the equal share (vote in the second best or in the median share) performed a lower effort than those who actually vote in the sharing rule decided by the majority of the group. This result is still highly significant when analyzing by type of subject (model 3 and 4), however, we can see that identity does
not have an impact on high ability subjects and do have in low abilities. We find that, in contrast to low abilities, effort of high ability types were not affected by the fact that the sharing rule was decided by majority or due to a tie. Moreover, we find that while the high abilities where sensitive to their beliefs of the effort that the other high abilities could perform, the low abilities were sensitive to their beliefs of the effort that the other low abilities could perform.

We also find an effect of session in high abilities level of effort when the equal share was the distributional rule decided by the group. This is due to group effects, as when the group dummies were taken out of the model this effect disappears. Period has an effect in all models, confirming a well known effect on group experiments, where higher the period lower the effort level.

E. Post-experimental questionnaire analysis

After the experiment subject had to answer individually several questions regarding their decisions during the experiment. Table 11 lists all the questions and their mean answers. The answer to question 1 (Q1) reveal that both in the voting and in the identity treatment the high ability members considered fair the distribution rule decided by the majority of the group. The low ability members considered fairer the distribution rule in the identity treatment than in the voting treatment, however, no significant differences were found. (Mann-Whitney test: Overall: p= 0.1927; high ability: p= 0.5449, low ability: p= 0.2024). Analyzing by sharing rule, we find that when the sharing rule decided by the group was the equal split, around 75 percent of members found it fair, no significant differences between types or treatment. When the sharing rule decided was the second best share, about 60 percent of high ability members found it fair and 67 percent of low ability members found it unfair. This data is relative to the voting treatment as in the identity treatment none of the groups voted for this distributional rule. When the sharing rule decided was the median share, in the voting treatment about 67 percent of the high abilities and 50 percent of the low abilities found it unfair. As this sharing rule was determined randomly due to a tie in some groups, participants’ answers could have been affected for this fact. In the identity treatment, 100 percent of the high abilities and 50 percent of the low abilities found fair that the majority of the group decided to use the median sharing rule. This
sharing rule was chosen after the majority of the members of the group have agreed on the numbers to choose in the next stage.

Concerning Q2, we find that the fact of being in their group influenced both high and low abilities in choosing equal sharing rule in both treatments. We find no differences between treatments (Mann-Whitney test: Overall: \( p=0.1043 \); high ability: \( p=0.1832 \), low ability: \( p=0.3040 \)). Regarding Q3, we find that being in their group influenced both high and low abilities in choosing a higher number. We find no differences between treatments (Mann-Whitney test: Overall: \( p=0.5690 \); high ability: \( p=0.9283 \), low ability: \( p=0.3447 \)).

Table 11: Post-experimental questionnaire

<table>
<thead>
<tr>
<th>Questions [coding in square brackets]</th>
<th>Mean values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Voting treatment</td>
</tr>
<tr>
<td></td>
<td>High ability</td>
</tr>
<tr>
<td><strong>Set 1 (all treatments)</strong></td>
<td></td>
</tr>
<tr>
<td>Q1. Have you considered fair the decision made by the majority of the group in the second stage? ( 1=\text{&quot;Fair&quot;}; 0=\text{&quot;Unfair&quot;} )</td>
<td>0.73</td>
</tr>
<tr>
<td>Q2. In the second stage, when you had to choose the distributional rule, the fact of being in your group had any influence? ( 0=\text{&quot;No&quot;}; 1=\text{&quot;yes, I chose Option A&quot;}; 2=\text{&quot;yes, I chose Option B&quot;}; 3=\text{&quot;yes, I chose Option C&quot;} )</td>
<td>1.6</td>
</tr>
<tr>
<td>Q3. In the third stage, when you had to choose the number, the fact of being in your group influenced your decision? ( 0=\text{&quot;No&quot;}; 1=\text{&quot;yes, I chose a high number&quot;}; 2=\text{&quot;yes, I chose a low number&quot;} )</td>
<td>0.87</td>
</tr>
<tr>
<td>Q4. In a scale from 1 to 10, please indicate the level of identification with your group during the experiment.</td>
<td>5.2</td>
</tr>
<tr>
<td><strong>Set 2 (Identity treatment)</strong></td>
<td></td>
</tr>
<tr>
<td>Q5. In the second stage, when you had to choose the distributional rule, the fact of being able to communicate with the other members of the group had any influence in your decision? ( 0=\text{&quot;No&quot;}; 1=\text{&quot;yes, I chose a more egalitarian distribution&quot;}; 2=\text{&quot;yes, I chose a less egalitarian distribution&quot;} )</td>
<td></td>
</tr>
</tbody>
</table>

Question 4 follows Chen and Li (2009), question on group attachment were subjects were asked to rank form 1 to 10 the level of identification with the group during the experiment. We find that overall the level of identification with the group
increased in the identity treatment (U-test, p=0.0855). Surprisingly, the high ability subjects have an average level of identification higher than 5 in both treatments and manufacturing identity does not have a significant effect on them (U-test, p=0.5040). In contrast, this effect is significant for the low ability subjects (U-test, p=0.0411).

Finally, regarding Q5, we find that communication influenced subjects voting decisions, especially of high abilities, but not as much as the simple fact of being in their group (Q2) (Wilcoxon sign-rank test: Overall: p= 0.0017; high ability: p= 0.0266, low ability: p= 0.0143).

We conjecture that there could be a minimal group effect on the high ability members. Accordingly to Tajfel and Turner (1979), just the fact of being in the same group can create group attachment and affect subjects decisions, even without interaction.

II. Conclusion and discussion

Accordingly to economic theory and previous experimental evidence heterogeneous teams should operate under a distributional rule that takes into account the differences in agents’ inputs. However, under non-hierarchical forms of organization, where members have to decide how to divide the total team output, subjects face group interactions, which can have an effect on their distributional preferences.

In this paper we experimentally explore how these social interactions affect teams mostly composed by high ability subjects in terms of distribution preferences and consequently on team efficiency. The main motivation of this work is to understand why so many self-managed teams and partnerships use an equal compensation scheme when members are heterogeneous in abilities. In addition, this study allows us to give recommendations to management in terms of incentive schemes, corporate culture and wealth creation. To this aim we compare two treatments which design is based on a team production model. The control treatment, which we call the voting treatment, is designed to understand the distributional preferences of members without social interaction. The second treatment, which we call the identity treatment, is designed to understand the effects of identity in distributional choices and effort levels. To enhance identity, we use a similar stage to Chen and Li (2009), where subjects perform a task before playing the team game with the possibility of chatting.
Moreover, we allow communication in the voting stage, as previous experimental evidence show that communication increases the level of identification of group members.

Our results indicate that in absence of social interaction subjects tend to vote in the distributional rule that leads them to better monetary payoffs. While the majority of the high ability members vote for the second best compensation scheme, which gives them a higher share of the total team output, the low ability members vote for an equal split. With identity the percentage of high ability members that vote on the equal share increase from 30 percent to 70 percent. This result indicates that identity has a strong impact on distributional preferences. Moreover, as the high majority of groups where identity was manufactured decide to operate under an equal distributional rule, identity can be an explanation for the use of equal splits in heterogeneous self-managed teams.

Surprisingly, we do not find that identity increases team efficiency when heterogeneous teams operate under an equal distribution of total output, as is the case with homogenous agents (Eckel and Grossman, 2005). Identity has a positive effect on low ability subjects, increasing their effort level, however does not have an impact on high abilities performance. Moreover, we find that the high ability members who do not vote on the sharing rule decided by the majority of the group highly decrease their effort level. We conjecture that they behave against the group goal as they feel as outsiders of the group. This result is consist with Akerlof and Kranton (2005) theory that suggests that when members feel as outsiders they gain utility when acting against the group norms.

Nonetheless, we find that identity equalizes individual payoffs. Therefore, we conjecture that difference aversion could be a consequence of group identity.

We do find that when groups operate under a proportional compensation scheme that weighs equal sharing and wealth maximization criteria, the median sharing rule in our experiment, subjects tend to increase their effort level and team efficiency highly increases. This is consistent with Amartya Sen (1966) theory that an optimal allocation of resources should give part to needs and part to abilities. Although few groups chose this distributional rule we highly recommend that self managed teams operate under this incentive scheme as it increases motivation of both high and low abilities and do not damage personal relationships.
A natural extension of this work is to allow communication in all rounds of effort, and see if it increases high ability levels of effort. Other extension could be allowing for renegotiation of the sharing rule after the 10 rounds period to understand if the high abilities maintain their votes on equal share under identity.

In resume, the results of this paper are a contribution to better understand the black box of self managed teams, and it is again a reinforcement that social variables, as identity, influence team member’s behavior in a way that their actions have more in consideration group effects than self maximization.

III. References


IV. Appendices

A. Model

Considering the specifications indicated in the theoretical framework. Agents’ utility is given by the expression:

\[ U_i = \left( (1 - \alpha)S_i^\alpha + \alpha/5 \right) \sum k_i a_i - a_i^2/2q_i, \text{ with } \alpha \in [0,1] \]  

The first best, welfare maximizing solution is obtained from the maximizing the aggregate of the individual utilities (\( U = \sum_{i=1}^{n} U_i \)) with respect to \( a_i \):

\[ \text{Max}U = \sum_{i}^{5} k_i (q_1, q_2, ..., q_5) a_i - \sum_{i}^{5} a_i^2/2q_i \]  

The optimal solution is

\[ a_i^{**} = k_i q_i, \]  

and a social welfare of

\[ U^{**} = \frac{1}{2} \left( \sum_{i}^{5} k_i^2 q_i \right) \]  

**Remark 1** Assuming \( q_h > q_l \) and \( k_h > k_l \) the optimal effort of the more able workers will be higher than the optimal effort of less able workers: \( a_h^{**} > a_l^{**} \)
As the total production of the team has to be fully distributed among the participants in the production process, in a team with N>1 members the first best is not achieved\textsuperscript{21}. The assignation of resources is obtained by the unilateral decisions of each participant. We first present the Nash equilibrium solution under the second best sharing rule (\(\alpha=0\)) and next we present the solution under the equal sharing rule (\(\alpha=1\)).

\subsection*{2.1.1. Nash equilibrium solution under the second best sharing rule (\(\alpha=0\))}

The Nash equilibrium solution for self-managed teams will result from simultaneously solving the N=5 problems:

\[ \text{Max}_{a_i} S_i \left( F(a_1, \ldots, a_5) - \frac{a_i^2}{2q_i} \right), \ i=1, \ldots, 5 \]  

(5)

The solution to this problem is:

\[ a_i^* = S_i k_i q_i \]  

(6)

The second best sharing rule is obtained from solving the two steps problem:

\[ \text{Max}_{S_i UT}(a_i(S_1 \ldots S_N), \ldots, a_N(S_1 \ldots S_N)) \]

Subject to \( \sum_{i} S_i = 1 \)

The solution to the two nested problems is:

\[ S_i^* = \frac{k_i^2 q_i}{\sum_{i} k_i^2 q_i} \]  

(7)

\textbf{Lemma 1: The second best sharing rule is non-decreasing on abilities.}

The second best sharing rule under heterogeneous agents is \textit{proportional to members' ability}. Therefore it implies a higher share of the output to the more able workers than to the less able ones: \( S_h^* > S_l^* \).

The equilibrium effort under the second best optimal sharing rule is:

\[ a_i^{*\text{SB}} = \frac{k_i^2 q_i^2}{\sum_{i} k_i^2 q_i} \]  

(8)

and the social welfare:

\textsuperscript{21} As demonstrated by Holmstrom (1982).
According to the utilitarianism principle, this sharing rule is the more equitable. Note that equal output sharing is second best optimal if all inputs have similar skills.

### 2.1.2. Nash equilibrium solution under the second best sharing rule ($\alpha=0$)

The Nash equilibrium solution for self-managed teams will result from simultaneously solving the $N=5$ problems:

$$\max_a \frac{1}{5} F(a_1, \ldots, a_5) - \frac{a_i^2}{2q_i}, \; i=1, \ldots, 5$$

The solution to this problem is:

$$a_{i}^{eq} = \frac{1}{5} k_i q_i$$

and the social welfare of:

$$UT^{eq} = \sum_{i} \frac{2 \times 5 - 1}{2 \times 5} k_i^2 q_i$$

**Lemma 2:** If $S_i \geq \frac{1}{5}$ then $a_{i}^{SB > a_{i}^{eq}}$ and $U_{i}^{SB} > U_{i}^{eq}$.

Whenever the proportion individual $i$ receives under the second best is higher than under the equal split he will do a higher effort under this sharing rule. Accordingly, his utility function ($U_{i}^{SB}$) will be higher under this compensation scheme than under the equal split ($U_{i}^{eq}$).

High ability members, who receive a higher share with the second best sharing rule, have incentives to exert a higher effort under this compensation scheme. On the other hand, low ability workers have more incentives to exert a higher effort under the equal sharing rule. Thus, for low ability members we have: $a_{j}^{SB} > a_{j}^{eq}$ and $U_{j}^{SB} > U_{j}^{eq}$.

**Propositions:**

a) Self-managed teams with output sharing and budged constraint imply free riding and inefficient inputs allocation in both equal sharing and
second best sharing rules. Inefficiency is higher under equal sharing than under second best rules: $a_i^{eq} < a_i^{SB}$, $a_i^{eq} < a_i^{**}$; $U^{eq} < U^{SB} < U^{**}$.

b) Equal output sharing is second best optimal iff all inputs have similar skills: $a_i^{eq} = a_i^{SB}$ iff $q_i = q_j$ for all $i$ and $j$.

c) Assuming standard preferences, it is a dominant strategy for more productive members to choose an $\alpha = 0$ since they will be better off with the second best sharing rule. Whereas it is a dominant strategy for less productive members to choose an $\alpha = 1$ since their individual profit will be higher with the equal sharing rule.

B. Instructions

Instructions for the identity treatment

You have been asked to participate in a study that analysis group decision making. During the experiment we will speak in terms of Experimental Monetary Units (EMUs) instead of Euros. Each participant will receive an initial endowment in EMU. You may earn an additional amount of money depending on your decisions in the experiment and others decisions. Your payoffs will be calculated in terms of EMUs and then converted to euros at the end of the experiment at a rate of 800 EMUs = 1 Euro. This money will be paid to you, in cash, at the end of the experiment. You will be given a set of instructions that will be read aloud to all participants. If you have any question, please raise your hand and one of the experimenters will go to you and your question will be solved.

The decision situation:

At the beginning of the experiment you and four other participants will be randomly assigned to your group. There will be 25 participants in the room that will be randomly assigned to the Blue, Red, Yellow, Green or White group. The identity
of the other participants will not be revealed and you cannot interact with the other members of the group unless you are asked to do it.

In your group there are three participants that will be called of type 1, and two participants of type 2. You will be random selected to be a type 1 or a type 2.

This experiment has two parts. The first part has one stage and the second part has two stages. In the first part you have to answer some questions about paintings. The second part is a decision game where you have to chose a number and how to allocate the earning your group made between yourself.

**Instructions for the first part:**

In the first screen of the experiment you should introduce your ID number. In the next screen you will know to which group you were assigned (Blue, Red, Green, Yellow or White). Next you will have 2 minutes to study 8 images, the first 4 are painting from Picasso and the last 4 are paintings from Dali. Next you will see 2 pictures more, and you have to answer who painted these pictures. On the right you find a chat box where you can chat with the members of your group to help or be helped in given the correct answers. Please do not identify yourself and do not use inappropriate language. For each correct answer you will earn 200 UME.

**Instructions for the second part:**

As referred earlier, there will be two types of players in your group, the type 1 and the type 2. You will know your type in the second stage, but will not know who are the others who that share your type or who are of the other type.

In the second stage you and your team members will have to choose how to allocate the amount of money made by the group. You have three options, and have to choose only one. The option decided by the majority of the group will determine the distribution of your and others payoffs.

In the third stage, you and the other three subjects of the group must choose a number between 0 and 240 without knowing the decisions of the other members of the group.
The election of this number has some implications. The number you choose will have a different value depending on your type: if you are type 1 the value of the number is the chosen number multiplied by 24 and if you are type 2 is the chosen number multiplied by 17 (see table k*number). The values of the chosen numbers off the five members of the group are add and each one of the members receives a percentage of that sum, we will call this sum RESULT. This percentage corresponds to the option decided by the majority of the group in the second stage.

On the other hand your chosen number causes a certain cost. As mentioned there are two types of participants in your group. Each type of participant has different cost associated to each possible number that you chose. This means that the type 1 participants have a cost for the chosen number that is equal among them but different of the cost that type 2 participants have for this number. The cost of the number that you chose will be deducted directly of your payoff.

In the moment that the experiment starts you will know which type of participant you are in the group and you can consult the cost table in the annex. In this table you can see the value and the cost that each number has for your type and for the other type.

You can also see that each number has a different cost. For the type 1 members the cost of the number is equal to the square of the chosen number divided by 20, while for the type 2 members it is equal to the square of the chosen number divided by 10.

In the next table you can see an example of how to read the table.

**Example Cost Table**

<table>
<thead>
<tr>
<th>Type 1</th>
<th>Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>Número</td>
</tr>
<tr>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td>24</td>
<td>15</td>
</tr>
<tr>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>24</td>
<td>50</td>
</tr>
<tr>
<td>24</td>
<td>149</td>
</tr>
</tbody>
</table>
You can read your cost table by looking down the second column where you can find the decision numbers; the third column informs you of the value of this number and in the forth column you can check the cost of this number. For example, if you are type 1 and choose the number 15, the value of this number is 360 and has a cost of 11.3, while if you are type 2 and choose the number 15, the value of this number is 255 and has a cost of 22.5. Note that the higher the number you choose the higher its cost.

Instructions for the first stage of the second part

After finishing the first part, the second part of the experiment will began. You will remain in the same group of the first part.

In the first stage of this part you will have to choose the distributional rule of the Result (sum of the value of the decision numbers choose by the five elements of the group). You have to choose between 3 options, knowing that the option decided by the majority of the group will determine your and others payoffs.

<table>
<thead>
<tr>
<th>Option A: Tipo 1: 30%</th>
<th>Tipo 2: 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option B: Tipo 1: 20%</td>
<td>Tipo 2: 20%</td>
</tr>
<tr>
<td>Option C: Tipo 1: 25%</td>
<td>Tipo 2: 12.5%</td>
</tr>
</tbody>
</table>

If the majority of members choose the option A, this means that each one of the type 1 members will receive 30 percent of the result, while each of the type 2 members will receive 5 percent of the result. If the majority of members choose the option B, all members receive 20 percent of the result, independent of the type. If the majority of members choose the option C, this means that each one of the type 1 members will receive 25 percent of the result, while each of the type 2 members will receive 12.5 percent of the result. From this percentage of the result it will deducted the cost of the number.

You can use the chat box to communicate with the others members of the group. Note that you can only chat in this stage. In the next stage, where you have to decide the number, you will not be allowed to interact with your team mates.
You can also use a help screen to do simulations about your and others earning.

**How to use the help screen:**

You can use the help screen to make simulations in relation to the number you can choose and the number that the other could choose. As you don’t know which number the other will choose, you can simulate typing a number between 0 and 240 in the correspondent field. If you press “calculate” you can see the value and cost of each of these numbers accordingly to the correspondent member. You can also see the final result of your simulation for each of the 3 options when press “see calculations”. At the bottom of the screen you can see the sum of the value of the numbers that you simulate as long as the proportions that you and the other elements of the group could receive. If you press “Decision screen” you turn to the decision screen. Your decision will be validate when you press the “continue” button.

**Instructions for the second stage of the second part**

After the distribution rule have been decided by the majority of the group, you will see a screen where you will know which of the options will determine yours and others payoffs. You have to insert a number between 0 and 240 in the correspondent field, if you press OK you can see the value and cost of the number as well as the proportion of the result that you will receive. You can use the help screen in this stage, but you cannot communicate with your group.

**Calculations of your payoffs:**

Your payoff in UME depends of the distribution rule determined in the first stage of the second part:

**Option A:**
- Payoff Type 1 = 0.30*Result - cost individual cost type 1
- Payoff Type 2 = 0.05* Result - cost individual cost type 2

**Option B:**
- Payoff Type 1 = 0.20*Result - cost individual cost type 1
- Payoff Type 2 = 0.05* Result - cost individual cost type 2
Option C:

Payoff Type 1 = \(0,25 \times \text{Result} - \text{cost individual cost type 1}\)
Payoff Type 2 = \(0,125 \times \text{Result} - \text{cost individual cost type 2}\)

In the case you suffer losses you will receive a minimum capital that range from 5 to 2 euros, depending on how much you loss.

Example of how your earning will be determined:

If, for example, each one of the members of the group choose the number 15. For the type 1 members, the number has a value of 360 and a cost of 11,3. For the type 2 members the number has a cost of 255 and a value of 22,5. the result will be: 360*3+255*2=1 590 EMUs.

If the option decided by the majority of the group was option A and you are a type 1, your payoff will be: \(0.30 \times 1590 - 11,3=465,7\) UME. If you are a type 2 members, your payoff will be: \(0.05 \times 1590 - 22,5=57\) UME.

If the option decided by the majority of the group was option B and you are a type 1, your payoff will be: \(0.20 \times 1590 - 11,3=306,7\) UME. If you are a type 2 members, your payoff will be: \(0.20 \times 1590 - 22,5=295,5\) UME.

If the option decided by the majority of the group was option C and you are a type 1, your payoff will be: \(0.25 \times 1590 - 11,3=386,2\) UME. If you are a type 2 members, your payoff will be: \(0.125 \times 1590 - 22,5=176,25\) UME.

Comprehension questionnaire:

1. Suppose that you are a type 2 member and choose a number of 5, the value of your number is _______ and the cost of your chosen number is _______. Suppose that the other type 2 member have chosen the number 50 and each one of the type 1 members have chosen the number 20, the total result is ________, Suppose that the distributional rule decided was option A, then your payoff is ____________.

2. Suppose that you are a type 1 member and choose a number of 2, the value of your number is ________ and the cost of your chosen number is _______. Suppose
that the other type 1 members have chosen the number 149, and the type 2 members
have chosen the number of 5, the total result is _________. Suppose that the
distribution rule decided by the group was the option B, then your payoff
is__________.

Thank you for your participation. After finishing the experiment please wait
at the computer in order to know your payoffs in euros and receive new
instructions for the next experiment.