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Doctoral Thesis

On Individual Decision Making and Responsibility for Others

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Abstract

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On Individual Decision Making and Responsibility for Others

by Federico Fornasari

Individuals' concerns for others have been the focus of many experimental investigations since the first appearance of the dictator game, which pointed out that, when people have to allocate resources and determine their own and others' payoffs, they decide accordingly to some well-defined distributional preferences. These, depending on the decisional setting and on individuals, are able to generate discrepancies between decisions that only affect the decision maker and choices that have consequences on others' payoffs. Starting from these considerations, the three studies presented in this thesis have the aim to picture the state of the art in the literature related to decision making and responsibility for others. Specifically, *Chapter 2* presents an overview of past contributions, providing an analysis of three different experimental literatures: dictator games, delegated decision making under risk, and leadership in cooperation; the last two are then experimentally investigated more in details in the following chapters. Specifically, *Chapter 3* focuses on investment in risk protection when risk is borne either by the decision maker or by another individual. In addition to this, the analysis manipulates who is the subject providing the resources to buy risk protection. Laboratory observations are assessed against behavioral predictions obtained from a linear model for social preferences to test its predictive power in this domain. *Chapter 4* drives the attention to the effect of leadership in a public good experiment. Leaders take part to a public good game, aware of the fact that every decision they make directly affects their followers, who can be either passive players or have the opportunity to send short messages to their leader. This experimental setting allows to observe how people decide for themselves and others when involved in strategic interaction.

Keywords: Experimental Economics; Distributional Preferences; Decision Making; Delegated Choices; Public Goods; Leadership

JEL-classification: C91; D03; D80; O12; C72; C92; H41; O12

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Chapter 1

Introduction

The first appearance of the dictator game (Forsythe et al., 1994) signed what can be considered a turning point in the body of literature related to individual other regarding concerns. Contrarily to the ultimatum game presented by Güth, Schmittberger, and Schwarze (1982), where recipients have the last word in determining final payoffs, the dictator game introduced a design where subjects assigned the role of dictator can purely express their distributional preferences.

Since then, many authors have been contributing to enrich knowledge about dictator games and individual allocation preferences, when they have to decide for themselves and for others (for an exhaustive review of the literature see Engel, 2011).

Since then, experimental economists have produced a great variety of contributions to this literature, trying to gradually enlarge the scope and test other dimensions related to situations where decision makers are not the only ones affected by the consequences of their choices (i.e. decision makers are responsible for someone else). Two of the most important domains are delegated decision making under risk and leadership and cooperation.

Delegated decision making under risk could be defined as a situation where the decision maker is asked to make a risky choice having consequences on others'. Taking this as a starting point, it is possible to understand how delegated decision making can be considered a task that individuals commonly face many times during their lifetime; it happens frequently, in fact, that we have the responsibility to decide for others, both in our private and professional lives. Think, for instance, of parents raising their children, doctors curing patients, or also financial consultants advising some investors.

The latter example is particularly relevant as behavioral experiments on delegated decision making have been mainly focused on this dimension, trying to analyze how individuals decide for others when investing money. Specifically, authors have tried to understand if people make different decisions when investing their own money rather than someone else's one.

Experimental findings are sparse and contradictory, and point out a complex situation: some studies provide evidence of delegated agents being more risk averse when deciding for someone else, while other studies suggest that agents are less risk averse over other people's money. Nevertheless, contributions to this literature allow to derive two main evidence: i) people delegated to invest others' money show other regarding concerns (Krawczyk and Le Lec, 2010; Lahno and Serra-Garcia, 2015), and ii) delegated agents tend to decide differently when investing their own money rather than others'.

Leadership and cooperation, on the other hand, represents a different decisional setting: a decision maker is usually appointed as leader of a group playing a public good game, and has to determine group contributions to the public good. This simple design can be complicated by the presence of other factors, such as, for instance, altruistic punishment, or a threshold to reach.

Contrarily to what regards delegated decision making, the great majority of results in the literature on leadership and cooperation show that, in general, leadership is able to produce an increase in contributions to the public good with respect to what observed in the traditional form of the game. This result is particularly important as it suggests that, when responsible for others, people tend to be more cooperative and efficiency oriented.

Despite these general findings, delegated decision making under risk and leadership in cooperation are two growing bodies of literature, and allow further tests and explorations. My aim is to create a general framework, collecting and describing the most relevant studies in the two fields, and to contribute to the literature presenting two experimental studies.

Chapter 2 presents the state of the art of research made on individual decision making and responsibility for others: first it provides an overview of the most important findings about dictator games, following the paper by Engel (2011); then, the chapter includes a review of relevant studies on delegated decision making under risk, and leadership and cooperation.

These domains can be considered as independent fields of study, but, at the same time, they have in common that decision makers are responsible for others' welfare. In fact, in these three experimental settings, participants are asked to make choices that directly influence the payoffs of the people they are matched with. This generates a psychological pressure that produces discrepancies in decision making that depend on who is bearing the consequences of these choices.

Engel (2011) finds that people generally tend to allocate a share of their endowment to their recipients: this confirms the presence of other regarding concerns. Nevertheless, the author explains how the domain of allocation preferences is complex and dependent from the decisional setting.

Similarly, my analysis on delegated decision making suggests that discrepancies across studies could be due to a mix of idiosyncratic experimental factors, such as the risk preferences elicitation method, individual risk preferences, or the incentives structure. In line with this, the present analysis also relies on the approach adopted by Crosetto and Filippin (2015), and provides a comparative overview of some elicitation tasks.

As for leadership in cooperation, all the articles I have analyzed in my meta-study show a consistent increase in cooperation when someone is appointed as leader of the group. Nonetheless, also in this domain, single experimental factors, such as the group size, the implementation of altruistic punishment, and the number of rounds, seem to affect cooperation in a significant way.

Chapter 3 is based on the working paper '*Investment in Risk Protection and Social Preferences: an Experimental Study*' (Fornasari, Ploner, and Soraperra, 2015), and it focuses on delegated decision making under risk. In this study, participants are divided into couples and assigned either the role of dictator or recipient.

Dictators are asked to allocate a certain sum to buy risk protection under two different conditions: when risk is borne by themselves, and when it is borne by the recipient they are matched with. At the same time, the cost to offset risk is manipulated, and can be borne by dictators or recipients.

This particular design allows to obtain four different treatments, and to observe delegated agents' behavior from two perspective: risk attitudes and the use of resources. The first has been already investigated experimentally, while, at the best of my knowledge, the latter is analyzed within this domain for the first time.

Subjects' behavior in the experiment is assessed against predictions derived from the model for social preferences by Charness and Rabin (2002). Results show, in line with behavioral predictions, that individuals buying protection from risk for themselves invest more when using others' resources rather than their own.

In addition to this, individuals are willing to invest more of their resources when buying protection for themselves than for others. Regarding delegated decisions, subjects asked to decide for others, generally, appear more risk averse, as they buy more risk protection than when choosing for themselves.

Chapter 4 is based on the working paper '*Tell Me How to Rule: Leadership, Delegation and Voice in Cooperation*' (Faillo, Fornasari, and Mittone, 2016) and, following some recent studies, presents an experimental test of the effects of intra-group leadership in a public good game.

Specifically, participants play a public good game that has the same structure of the one implemented by Fehr and Gächter (2000), but are randomly assigned either the role of leader or the role of follower. Leaders take part in the game, aware of the fact that every decision they make directly affects their followers.

From this point of view, the experimental setting combines the dimension of leadership in cooperation with the one of delegated agents, and, for the first time, adds the dimension of cooperation between leaders of different groups. In fact, previous studies have been focusing only on how leadership affects intra-group cooperation.

Results show that leadership produces two main effects: subjects contribute more, and tend to punish more frequently. However, in spite of the presence of higher contributions, the implementation of leadership lowers final payoffs. This seems to be due to the aggressive behavior that leaders exhibit: responsibility for others leads them to an undue use of punishment.

Allowing one-way communication from followers to leaders, it is possible to observe a change in leaders' behavior: communication reduces their aggressiveness, leading to lower average contributions, yet, at the same time, to a reduction in punishment. This results in higher average payoffs. In addition, it is interesting to notice how payoffs under the communication condition do not statistically differ from the ones obtained when leadership is not implemented at all. This suggests that the presence of a dictatorial leader in public goods with punishment can be beneficial only when there is a democratic approach that allows communication.

Chapter 5, finally, presents the concluding remarks of the thesis and provides an overview of the main results obtained. It also explains what could be the most important implications, and limitations of the findings presented, suggesting some further studies that could be considered to contribute to the literature.

Chapter 2

Responsibility for Others in Allocation Tasks: An Analysis

2.1 Introduction

Past studies have widely documented how individuals show allocation preferences even in simple economic choices involving other individuals. Testing and analyzing such preferences, many scholars have provided a fundamental turning point: Güth, Schmittberger, and Schwarze (1982) undoubtedly need to be cited among these. For the first time, the authors implemented an allocation game able to capture individual's preferences in terms of self and others' payoffs: the *ultimatum game*.

Güth, Schmittberger, and Schwarze (1982) divided subjects into couples and assigned them either the role of donor or recipient, letting dictators decide how to split a sum of money; recipient could accept and end the game with the allocation chosen by the donor, or reject and end the game with zero payoffs for both. The authors found that people are characterized by certain defined preferences able to affect their decisional process, at the point that recipients prefer to turn down a rationally acceptable economic offer, if they do not consider it fair. Donors, on the other hand, are not free to advance purely selfish offers as they anticipate the psychological and monetary cost of a possible rejection.

In order to observe individuals' allocation preferences and to explore in a deeper way the concept of fairness, as this emerged from Guth et al's study, Kahneman, Knetsch, and Thaler (1986) implemented a modified version of the ultimatum game, finding that individuals were willing to give up part of their own earning to generate a more fair general outcome.

Few years later, Forsythe et al. (1994) questioned the identification of fairness as the main determinant of people's choices. The authors analyzed subjects' decisions, drawing a comparison between an ultimatum game and a *dictator game*. The two games have similar settings; however, in the dictator game recipients do not have any power, and thus the game always ends accordingly to dictators' choices. Forsythe et al. found that fairness is not the unique key to interpret dictators' offers, as these varied from one game to the other.

This and other findings set the ground for following studies, aimed to explain individuals' allocation preferences, and to develop models able to describe and predict people's behavior. These are known as models for *social preferences*. Many authors contributed to this literature, some focusing on the role of individuals' intentions and reciprocity (Rabin, 1993; Dufwenberg and Kirchsteiger, 2004; Falk and Fischbacher, 2006), others assuming altruistic motives (Andreoni and Miller, 1996; Levine, 1998), and others introducing the concept of inequity aversion.

Fehr and Schmidt (1999), belonging to the latter group, developed a model following previous theories about altruistic behavior, and added a strategic component built on individuals' preferences for equity outcomes. Specifically, the authors were able to explain how people tend to constantly drive comparisons between their own wealth and their peers' one.

Bolton and Ockenfels (2000) developed a similar model: they argued that people's choices are, as defined by Fehr and Schmidt (1999), justified by their own payoffs and their relative standing, but specify that the latter as to be compared to the average payoff, instead of driving one-to-one comparisons with all the other individuals involved. Furthermore, the authors assume that people do not derive any utility when applying small deviations from an equal distribution. This assumption is particularly relevant as it justifies non-equal splits in allocation games (e.g. the ultimatum game).

Charness and Rabin (2002) obtained additional experimental data to test people's concerns for others in allocation experiments, and built a new model for social preferences. Comparing their data with previous models, the authors realized that inequity aversion could not capture all the decisions observed experimentally. Thus, they found necessary to classify individuals depending on their allocation, and social, preferences into a greater number of categories: selfish, spite, inequity averse, and welfare enhancing.

Once clear the relevant role of social preferences, more experimental studies tried to shed new light on individuals' decision making involving other regarding concerns. In the past, these mainly focused on people's interactions with purely deterministic outcomes. Recently, the analysis of social preferences has been extended to decision-making under risk, cooperation and delegated agents (defined as risky decision-making with consequences on others' welfare).

This work aims to combine findings from independent studies involving allocation games and delegated agents. To this purpose, I first discuss the results gathered and analyzed by Engel (2011), who provides a complete and exhaustive study about dictator games experiments. Despite they do not directly refer to the field of delegated decision-making, I included them in my analysis because of the similarity between dictator games and delegation. They only differ with respect to the nature of final payoffs, which are, in the case of dictator games, deterministic.

Then, I present two analyses: one based on experimental studies on delegated decision making under risk, and one focused on leadership and cooperation in public good experiments. My main purpose is to point out the most relevant findings, and to identify the common patterns underlying people's choices in these two domains. Subsequently, I draw general conclusions on delegated decision-making, integrating my results with those obtained by Engel (2011).

2.2 Dictator Games

Engel (2011) provides an exhaustive and rich analysis of all the studies on dictator games the author was able to find (for similar studies see Camerer, 2003; Cardenas and Carpenter, 2008). Engel gathered data from 131 papers, for a total of 616 treatments, including both published and unpublished works[1]. He only excluded from his analysis studies where recipients had any sort of power, or any possibility to communicate with the dictator. This was made

[1]As Engel explains, this was made with the intent to prevent the publication bias, presented by Thompson and Pocock (1991).

in an attempt to focus on the original structure of the game and its features; any psychological effect derived from recipients' power could have, indeed, influenced dictators' pure allocation preferences.

As reported by the author, such a large body of literature aims to test many different manipulations under the most diverse conditions. This suggests that the dataset had to be managed taking into account its heterogeneity. What makes Engel's work particularly important is, in addition to the large number of experiments he managed to collect, the fact that he was almost always able to obtain the standard errors. This allowed him to use a much more precise econometric model (Harbord and Higgins, 2008), distinguishing his work from most of the other meta-analyses that are based on the number of observations per study, rather than data distribution.

The first result reported by Engel explains that dictators share, on average, 28.35% of their endowment with the recipients they are matched with. Furthermore, the left skewed distribution of offers suggests, as already pointed out byCamerer (2003), that dictators tend to give small shares[2]. Additional results, describing different distributional preferences, are derived from the dataset with individual observations that Engel reconstructed: 36.11% of the offers were equal to zero, 16.74% equally divided the endowment, and 5.44% transferred everything to the recipient.

In order to provide additional details, Engel presents an analysis of the explanatory factors involved in the studies forming his dataset. As the number of different manipulations in the sample is large, it is possible to identify many diverse independent variables. What emerges is that some have a certain relevance when considered at a single experiment level, but their effect is much less significant (if not at all) in the full meta-analysis dataset. In particular, the author focuses on manipulations concerning incentives, social control, distributive concerns, framing, social distance, and demographics.

Among the factors influencing dictators' offers, Engel indicates some that are significant across all the studies. Offers are higher when the recipient is deserving, when there is more than one recipient, or dictators are old. Furthermore, when dictators' identities are disclosed, social pressure increases offers.

[2] In 6 out of the 616 treatments the average is equal to zero.

Similarly, dictators are more willing to give when the money sent to the recipient is multiplied. Engel specifies that under these conditions, dictators do not advance generous offers, but they show a more positive attitude towards giving: they give little, but more than zero.

On the other hand, Engel also finds factors negatively affecting dictators' willingness to give. When, for instance, dictators earn their own endowment they are more reluctant to give: it frequently happens that they offer zero. Also, dictators give little when recipients already own an endowment, or when a concealment option is available. Other relevant factors are repeated decisions and group decisions. While the former can be justified by hypothesizing that dictators perceive these repeated offers as continuous losses, the latter finds an explanation in the relief of social pressure due to the presence of other decision makers. In this sense, a solitary dictator may feel bad in giving little, or not giving at all; nevertheless, when the decision is shared, even low offers become socially acceptable.

Engel concludes his analysis explaining how, in spite of the number of contributions, the literature on dictator games is still growing. Kahneman, Knetsch, and Thaler (1986), and subsequently Forsythe et al. (1994), proved that the classical definition of *homo oeconomicus* does not provide the right basis to build decisional models. Individuals have utility functions involving distributional preferences that are much more complex than the simple assumptions of selfishness and income maximization. From that moment on, thanks to its simple structure, the dictator game allowed many researchers to investigate an incredibly large number of different novel aspects from both an economic and psychological point of view. All these contributions have irreversibly changed the approach to the study of the individual decisional process, underlining the importance of people's concerns for others. More recently, authors have driven their attention to related studies that still focus on distributional preferences, but are characterized by a more complicated structure and by indeterministic outcomes.

2.3 Delegated Decision Making Under Risk

In a pioneer study Binswanger (1980) proves that subjects taking part to experiments show certain attitudes towards risk. Since then, many authors have contributed to this field proposing diverse methods to elicit individuals' risk preferences. Andersen et al. (2006) bring evidence of the fact that subjects are, in laboratory experiments, generally risk averse.

More recently, authors have started focusing on how these risk attitudes interact with people's distributional preferences (Trautmann and Vieider, 2011). In particular, they aim to understand whether people make different choices for others (i.e. when they are delegated agents) with respect to what they decide for themselves, and whether these choices can be attributed to individual social preferences. Krawczyk and Le Lec (2010) find evidence of individuals' efficiency concerns, while Lahno and Serra-Garcia (2015) provide results that appear to be equity oriented. Although these studies have different approaches, the influence of social preferences on subjects' choices seems to be relevant.

Other studies contributed, more generally, to the analysis of delegate decision making, leaving aside the aspects related to social preferences. Some authors (Andersson et al., 2014; Chakravarty et al., 2011) find that agents are more risk averse over their own money rather than when asked to invest others' one; Agranov, Bisin, and Schotter (2014) define this as the *Other People's Money Effect*. At the same time, other studies (Pahlke, Strasser, and Vieider, 2015; Eriksen and Kvaløy, 2014) find evidence of the opposite: i.e. individuals are more risk averse when managing others' money than their own.

One of the main causes of the discrepancies emerged in the literature on self and delegated decision making under risk, could be the risk elicitation method used; in fact, as pointed out by Crosetto and Filippin (2015), different elicitation procedures can generate diverse measures of risk preferences within subjects. Following, I describe the most common risk elicitation tasks found in this body of literature, and the results of the studies on delegated agents related to them.

2.3.1 Risk Elicitation and Delegated Decision Making

For this analysis of the literature about delegated agents, I collected 10 experiments, including both published and unpublished works.[3] Other studies, f.i. Polman (2012), drive the attention on self and delegated decision making, mainly focusing on loss aversion; thus, although their contribution is relevant to the field, they do not specifically fit my analysis.

Table 2.1 provides an overview of the studies I analyze, specifying for each the risk elicitation method utilized during the original experiment.

Table 2.1: Experiments and Elicitation Methods

Experiment	Elicitation Method
Agranov, Bisin, and Schotter (2014)	Custom
Andersson et al. (2014)	MPL
Bolton, Ockenfels, and Stauf (2015)	MPL
Chakravarty et al. (2011)	MPL
Eriksen and Kvaløy (2014)	GP
Fornasari, Ploner, and Soraperra (2015)	BDM
Füllbrunn and Luhan (2015)	GP
Güth, Levati, and Ploner (2008)	BDM
Hsee and Weber (1997)	Custom
Pahlke, Strasser, and Vieider (2015)	Custom

BDM: Becker, DeGroot, and Marschak (1964), GP: Gneezy and Potters (1997), MPL: Multiple Price List.

Multiple Price List (MPL)

The most widely known version of the MPL procedure was presented by Holt and Laury (2002). Subjects are presented a list of dichotomous choices between lotteries with increasing expected value: lotteries are organized into pairs, where one lottery is safer than the other. For each pair, subjects have to choose one of the lotteries; at a certain point of the list, subjects with monotonic preferences switch from the safer option to the riskier one, revealing their risk preferences. Nevertheless, some individuals present inconsistent behaviors, showing multiple switching points: in order to analyze these observations, it is required the use of a stochastic decision model.

[3] The studies I consider here allow to be compared from a methodological point of view, and they all include tests of self and delegated decision making under risk.

One of the study on delegated decision making using the HL procedure[4] is Bolton, Ockenfels, and Stauf (2015). The authors presented 5 different treatments, all involving risk taking in social context: the social risk dimension was manipulated in a between subjects fashion, and payoffs could be either perfectly positively or perfectly negatively correlated. In the former case, payoffs of players belonging to the same couple are identical; in the latter, one of the two players receive the high payoff and the other the low payoff of the selected lottery. Furthermore, the authors added a test on delegated agents' choices: in two treatments, they are informed about their peer's risk preferences. Bolton, Ockenfels, and Stauf (2015) found that payoffs correlation does not generate statistically significant differences, but responsibility for others individuals increases risk aversion. Without information about others' risk preferences, the average number of safe choices is equal to 5.56 (sd 1.58) for self decision making and to 5.92 (sd 1.46) for delegated choices. With information, the average number of safe choices is equal to 5.94 (sd 1.48) for self decision making and to 6.68 (sd 1.36) for delegated decision making.

Another contribution using the same elicitation method is provided by Chakravarty et al. (2011). The authors tested in a within subjects fashion the effect of responsibility for others, adding a control for the order effect, and found that delegated agents are less risk averse over others' money. Results show that the average number of safe choices is equal to 6.35 (sd 1.65) for individual choices and to 5.03 (sd 1.79) for delegated choices.

Andersson et al. (2014) implemented an experiment testing four different treatments. Under the *individual* condition subjects were asked to decide for themselves and got paid accordingly, while under the *other* condition their decisions determined someone else's payoff. In order to drive a meaningful comparison between these two treatments, the authors introduced the conditions *hypothetical*, where subjects' monetary incentives are removed, and *both*, where monetary consequences for both subjects are involved at the same time. The task, as reported by the authors, involved four MPLs: two with gains and two with losses. Each MPL was composed of 10 binary choices between lotteries: the safe lottery was constant, the risky lottery had increasing payoff, and

[4] The authors modified the original payoff structure, tripling the values of lotteries and converting them into Euro currency.

probability was always equal to 50%. Experimental results in terms of average number of safe choices over two lists are summarized in the table below.

Treatment	Gains	Losses
individual	10.5	10.7
other	10.5	9.8
hypothetical	10.5	9.3
both	10.5	9.8

In general, results suggest that in the domain of gains there is no difference across treatments. When there are losses, delegated choices are made with a lower risk aversion with respect to individual choices. Authors claimed that this decrease in risk aversion derives from a decrease in the loss aversion in delegated decision making.

The Investment Game (GP)

Gneezy and Potters (1997) were the first to present this procedure, where subjects are asked to express their preferences over an investment decision. They receive an endowment and can decide how much of it they want to allocate to a risky investment: the lottery pays back 250% of the invested amount with probability 1/3, while the investment is lost with probability 2/3.

Following this procedure, Eriksen and Kvaløy (2014) presented an experiment based on a 2 (*own* v *other*) x 2 (*frequent* v *infriquent*) treatments matrix. One manipulation is related to the person affected by the choices made during the task, while the other is related to the frequency of feedback about previous decisions and aims to investigate myopic loss aversion. The task included 9 sequential independent investment decisions: in every round the decision maker received an endowment equal to 100 ECU and was asked to decide the amount k to invest in the risky prospect. The average amount invested in the risky prospect is equal to:

Treatment	Frequent	Infrequent
own	49.2	59.1
other	46.7	51.7

Subjects appear affected by myopic loss aversion: they take systematically less risk when the evaluation is frequent under both conditions *own* and *other*.

Regarding delegated decision making, investors show a greater risk aversion over others' money than over their own.

Another experiment based on the same task was presented by Füllbrunn and Luhan (2015). In the first treatment (*own*) individuals were asked to decide how much to invest from an endowment of 9 Euros. The second treatment (*other*) asked the decision maker to act as money manager for six passive players: they were endowed with 9 Euros each and the money manager, who didn't get paid, had to decide a unique investment value for all of them. The last treatment (*lea*) was equal to the previous one, but players' incentives were aligned. Treatments were applied in a within subjects fashion and produced the following results: the average investment was equal to 4.6 Euros in the treatment *own*, 3.9 in the treatment *other*, and 4.0 in the treatment *lea*.

Others' money was managed with an higher risk aversion, and this is true also when the money manager's incentives are aligned to the investors' ones. The study by Füllbrunn and Luhan (2015) is important also because introduced the dimension of the group investment, making the delegated agents decide for more people at the same time, and increasing the sense of responsibility.

A small comparison

Elicitation methods produce diverse measures, since they differ according to precision, completeness of choices, and the presence of a safe option, for instance. In fact, following the procedure adopted by Crosetto and Filippin (2015), it is possible to convert data into a common scale, and to see how differently HL and GP map choices into a common parameter r, which represents the coefficient of a relative risk aversion utility function $U(x) = x^r$.[5]

Each of the two tasks has been parametrized on 10 choices: HL already classifies risk preferences in 10 different categories, depending on the number of risky choices made by the decision maker; according to the proportion of the endowment invested in the risky prospect, it is possible to identify the same number of categories for risk aversion elicited by means of the GP procedure.

[5] A similar exercise can be also found in Harrison and Rutstrom (2008).

Table 2.2 presents a comparison between risk preferences elicited across studies using the procedure by HL and GP.[6] For each treatment I report average choices and the corresponding risk coefficient.[7]

TABLE 2.2: Risk Preferences Across Elicitation Methods

Experiment	Task	Choice Set	self	other	leader	r self	r other	r leader
Bolton, Ockenfels, and Stauf (2015)								
info	HL	[0; 10]	4.06	3.72	-	0.47	0.37	-
no info	HL	[0; 10]	4.44	4.08	-	0.58	0.48	-
Chakravarty et al. (2011)	HL	[0; 10]	3.65	4.97	-	0.35	0.72	-
Eriksen and Kvaløy (2014)	GP	[0; 100]	49.16	46.66	-	0.68	0.66	-
Füllbrunn and Luhan (2015)	GP	[0; 9]	4.55	3.90	3.98	0.69	0.66	0.66
From the literature								
	HL	[0; 10]	4.37	-	-	0.60	-	-
	GP	[0; 4]	2.23	-	-	0.70	-	-

Bolton, Ockenfels, and Stauf (2015) (treatment *no info*), Eriksen and Kvaløy (2014), and Füllbrunn and Luhan (2015) show a common increase in risk aversion when responsibility for others is involved. Furthermore, translated risk preferences for individual risky choices are in line with the literature[8]: a rough comparison confirms that, when the GP procedure is adopted, the coefficient of relative risk aversion is greater than when preferences are elicited using the HL task; this seems to be true for both individual and delegated decision making. However, as pointed out by Crosetto and Filippin (2015), this difference might be due to a number of reasons, related to the features of tasks themsleves.

In a similar manner, Füllbrunn and Luhan (2015) report an increase in risk aversion in case of delegation; in addition, the implementation of incentives alignment does not produce significant effects on the extent of risk-taking observed in self and delegated decision making.

More in general, estimations obtained using the GP method produce results that are similar across experiments. In contrast, Chakravarty et al. (2011) report that subjects decide with a lower risk aversion over others' money with

[6]Although the elicitation method used is a MPL, I exclude Andersson et al. (2014) because data reported in the article do not provide sufficient details to estimate the risk parameter r.

[7]The papers considered in the analysis do not provide details about median choices; for this reason, risk coefficients are computed relying on average values. To increase the precision of this comparison, I considered the approximated mean value of the estimated rs.

[8]Results from the literature corresponds to the ones reported by Crosetto and Filippin (2015).

respect to what done with their own. This difference from the findings reported by Bolton, Ockenfels, and Stauf (2015), could emerge from a different experimental feature: Chakravarty et al. (2011) implemented a payoff structure where decision makers and others' incentives are not aligned, while they are in Bolton, Ockenfels, and Stauf (2015). Furthermore, it is important to note that the average number of risky choices found by Chakravarty et al. (2011) is remarkably lower if compared to the average emerged from the literature; this must be taken into account as a possible determinant of the strong decrease in risk aversion observed in delegated choices.

Becker-DeGrot-Marschak (BDM)

The BDM procedure, named after the author who introduced it (Becker, DeGroot, and Marschak, 1964), asks subjects to express the minimum selling price they would accept to sell a risky lottery they are endowed with. Then, a random number between the lowest and the highest value of the lottery is drawn: if this is equal to ora greater than the stated price, subjects receive an amount equal to the drawn number; if the drawn number is lower than the stated price, subjects fail to sell the lottery and play it to determine their final payment.

In Güth, Levati, and Ploner (2008) subjects were asked to evaluate prospects including a sure option and a lottery, that could determine their own payoff together with the one of a subject they were paired with. Each prospect consisted of a risky lottery paying 38 ECU or 16 ECU with equal probability, and a sure value equal to 27 ECU. Depending on the treatment, the risky lottery was assigned to the decision maker (*own*), to the passive partner (*other*), or to both (*both parties*). Decision makers had to express a minimum selling price for each prospect: this could range from 8 ECU to 46 ECU. The elicitation of the certain equivalent took place by means of a BDM procedure: if this was successful, the prospect was sold and the passive partner didn't get paid; in the other case, the prospect was not sold and payoffs were determined by playing it out.

The authors observed differences across treatments: when the risk was borne by the passive partner, the average bid placed by the decision maker was equal to 29.9, while when risk was borne by the decision maker the average is 28.3; when risk is borne by both parties, the average bid is equal to 28.4. As one can see at a first sight, average bids are very close to risk-neutrality (the expected value of the lottery is equal to 27 ECU). However, Güth, Levati, and Ploner (2008) provided also a detailed analysis of individual types: they observed that the majority of subjects are risk averse (the difference in reservation prices between the prospect involving no risk and the prospect involving risk only for the decision-maker is positive). Similarly, they considered subjects' preferences for social allocation of risky prospects: specifically, for every subject, they computed the difference in reservation prices between the prospect involving risk only for the decision-maker and the one involving risk for the passive partner. Combining individual risk attitudes and social risk orientation, a risk-averse participant who prefers the prospect including risk for herself rather than for the other can be considered as other-oriented with respect to risk: 22 out of 32 subjects evaluated more a prospect including risk only for themselves than one including risk only for the partner. With this respect, Güth, Levati, and Ploner (2008) found a strong positive correlation between risk aversion and social orientation: this seems to imply that delegated choices are made with a lower risk aversion when incentives are not aligned. However, Güth, Levati, and Ploner (2008) did not observe any significant difference with aligned incentives.

Using the same elicitation method, Fornasari, Ploner, and Soraperra (2015) presented an experiment on investments in risk protection aimed to investigate two aspects: the subject bearing the risk of an uncertain payoff (*self* v *other*), that could assume an integer value between 8 and 12 with equal probability, and the subject paying to buy risk protection (*self* v *other*). The treatments related to cost were applied between subjects, while those related to risk were applied within subjects.

The decision maker, who was paired with another individual, was asked to bid to avoid risk when this was borne by himself or the player he was paired with. The outcome of the bid was determine following a BDM procedure and, depending on the treatment, the cost was borne either by the decision maker or by his peer. Bids could range from 0 to 6 Euros: the average bid placed by decision makers when they borne the risk and paid for protection was equal to 1.78, while when their peer borne the risk and was charged the cost of protection was equal to 2.47.

Custom

In this section, I include studies using elicitation method that could not be categorized in the procedures listed above, even if these present some common features. For instance, Hsee and Weber (1997) and Pahlke, Strasser, and Vieider (2015) refer to the concept of certain equivalent for the elicitation of risk, yet without employing a BDM procedure.

Specifically, Hsee and Weber (1997) investigated discrepancies across self and delegated decision making by implementing different tests. The first is based on a 2 (*self* v *other*) x 2 (*gain* v *loss*) x 2 (*large* v *small* payoffs) treatments structure. The task was base on a set of seven pairs of lotteries, each including a sure amount and a risky option. In the treatment gain with large payoffs the risky lottery gave 2000$ or 0$ with probability 50%, while the *sure* option ranged from 200$ to 1600$ with a step of 200$; absolute values of payoffs are equal under both the gain and loss conditions, while under the *small* payoff conditions they were equal to 1/20 of the corresponding payoffs under the large condition. Results, in terms of the average switching point from the risky option to the sure one, are reported below.

Domain	Payoffs	Self	Other
Gain	Large	2.5	3.5
Loss	Large	3.6	4.5
Gain	Small	3.9	4.6
Loss	Small	3.6	4.2

The general tendency in this first test seems to be for delegated agents to decide with lower risk aversion over others' money with respect to what they decide over their own.

Another of the tests presented by Hsee and Weber (1997) employed a 3 (*self* v *next person* v *others on campus*) x 2 (*gain* v *loss*) treatments structure. In this case, the set included 9 choices between a sure amount or a risky lottery. The latter paid 5000$ or 0$ with probability 50%, while the sure amount ranged from 500$ to 4500$ with a step of 500$. The six treatments produced the following results:

Domain	Self	Next Person	Others on campus
Gain	2.0	1.9	2.5
Loss	4.0	4.4	4.9

Based on this test, the authors were able to introduce a distinction between the abstraction and the vividness of the person delegated agents are asked to decide for.

Pahlke, Strasser, and Vieider (2015) tested the effect of responsibility in delegated decision making with two treatments: in the *individual* treatment subjects determined their own payoff, and in the *responsibility* treatment they had to determine their own payoff and the one of an unknown subjects within the lab. Each subject was asked to evaluate 8 pairs of options: 7 including a sure amount and a 50-50 risky lottery, and one including a 50-50 safe lottery and a 50-50 risky lottery.

The authors found that delegated choices are made with more risk aversion in the gains domain; in fact, in the treatment *individual* the average percentage of safe choices was equal to 66.6%, and to 72.7% in the treatment *responsibility*. The loss domain showed an inverse tendency, with a value of 63.0% for the *individual* and 58.6% for the *responsibility*. No difference was observed in the mixed prospects.

Agranov, Bisin, and Schotter (2014) implemented a different design, using safe and risky lotteries into an investment framework to elicit individuals' risk preferences. Subjects were assigned either the role of investors or money managers, whose returns depended on the decisions made over their money (*own money*) or the investors' one (*risk sharing*). The task included 20 choices between a risky prospect paying 0 tokens or 10 tokens with probability 0.5, and a safe prospect paying 0 tokens or 7 tokens with probability 0.1 and 0.9, respectively. In the treatment *own money*, all players had to choose which lottery they prefer to play to determine their own payoffs; in the treatment *risk sharing*, subjects assigned the role of money manager competed in couples, offering a share of their earnings, to obtain one investor's trust to choose a lottery determining both the investor and the selected money manager's payoffs.

Subjects appeared less risk averse when investing others' money rather than their own. In particular, the average percentage of safe choices in the treatment *own money* was equal to 21.5%, while in the *risk sharing* this was equal to 39.2%.

2.3.2 Discussion

The previous section presented some of the contributions to the body of literature on delegated decision making under risk, specifying what risk elicitation method was implemented during the experiment. As explained, these can be one of the main reasons why discrepancies across studies in this field are observed; in fact, if some authors observe a lower risk aversion in delegated decision making, others provide evidence of delegated agents investing others' money with a greater risk aversion with respect to how they invest their own.

Trying to summarize the experiments analyzed, I observe that studies based on the MPL elicitation method provide different results: Bolton, Ockenfels, and Stauf (2015) find that risk aversion is greater when subjects decide for others, while Chakravarty et al. (2011) present evidence of the opposite. With this respect, it is worth noticing that the analysis of the coefficient of relative risk aversion reveals an undeniable difference between average risk-taking from the literature, and the one reported by Chakravarty et al. (2011). Finally, Andersson et al. (2014) report no difference between self and delegated choices in the domain of gains, but they find a lower risk aversion when subjects decide for others in the domain of losses.

Given the small number of studies on delegated decision-making adopting the HL task, it is not possible to draw clear conclusions. This procedure presents relevant advantages, since it allows to capture the whole range of risk preferences, and it does not include an actual safe option (Crosetto and Filippin, 2015); therefore, it would be useful to test experimentally the robustness of a shift in risk preferences in self-other decision-making, relying on this procedure. However, it is also true that this elicitation method suffers from a lack of precision, generated by the fact that risk preferences cannot be categorized continuously.

Eriksen and Kvaløy (2014) and Füllbrunn and Luhan (2015) provide their contribution eliciting risk preferences through the GP method: both studies find that delegated agents show a greater risk aversion when deciding for others. Thus, the GP seems to produce consistent results in this type of experiments, even if it needs to be considered that this procedure might induce loss aversion, and allows to capture only risk aversion. These results are consistent also if qualitatively compared to the ones obtained in studies where risk is elicited by a BDM mechanism: Fornasari, Ploner, and Soraperra (2015) and Güth, Levati, and Ploner (2008) support findings suggesting that delegated agents invest other people's money with greater risk aversion. However, I am aware that a detailed comparison across procedures needs to take into account the idiosyncratic features of each task: in these specific experiments, the average bids show risk aversion, but, in general, unlike the GP task, the BDM procedure is able to capture the whole range of risk preferences.

Regarding the three experiments I do not classify, Agranov, Bisin, and Schotter (2014) and Hsee and Weber (1997) both provide evidence of the fact that individuals are less risk averse when delegated to make risky choices rather than when deciding for themselves. On the other hand, Pahlke, Strasser, and Vieider (2015) find, distinguishing between gains and losses, that delegated choices are made with more risk aversion in the former domain and lower risk aversion in the latter domain.

In general, this analysis suggests that subjects, when asked to make decisions over others' money, show a greater risk aversion than when they decide over their own money. Results obtained with elicitation methods other than BDM and GP appear not consistent, yet, they produce an interesting insight: when focusing on the domain of losses[9], delegated agents seem to be less risk averse over others' money.

2.4 Leadership in Cooperation

Delegate decision making can be considered, from a psychological point of view, as an expression of the social pressure one experiences when deciding over someone else's wealth. This idea can be generalized and extended to a wider dimension, involving individuals' choices consequences on the collectivity, and analyzing how people behave when they are asked to cooperate in a *public good*

[9] I refer to the experiment conducted by Andersson et al. (2014), Hsee and Weber (1997), and Pahlke, Strasser, and Vieider (2015).

dilemma, but also how people decide when they are responsible for a common good.

Cooperation in social dilemmas has been the focus of many studies in the past, ranging over different domains (Dawes, 1980, Stroebe and Frey, 1982, Messick and Brewer, 1983, Van Lange et al., 1992, Komorita and Parks, 1994, Wilson and Wilson, 2007); one of the most relevant contributions is provided by Axelrod and Hamilton (1981), who applied game theory to political science, in order to identify the benefits of cooperation in iterated prisoner dilemmas, both from a psychological and economic point of view. Authors found that, contrarily to grounded rational expectations, individuals show a certain willingness to contribute to public goods. Nevertheless, when the game is repeated for a finite number of rounds, people decrease contribution, showing free-riding behaviors while the end of the game is approaching. In particular, subjects usually contribute with an amount between 40 and 60% of their entire endowment during the first rounds of the game, and 0 in the final rounds, so that the overall average contribution across rounds is more or less equal to the 20% of the total endowment.

This phenomenon, known as *end-game effect*, can be partially limited by introducing the possibility for subjects to punish free-riders and low contributors; in fact, as documented by Fehr and Gächter (2000), when punishment is allowed, the contribution pattern is in general more constant across rounds. Furthermore, the use of punishment increases and sustains cooperation in public good games, leading to a higher overall average contribution, which is, more or less, equal to 50% of the endowment.

Reviews on public good games (Zelmer, 2003; Chaudhuri, 2011) can provide a good overview of all the different factors many authors tested: some of them are more related to the social dimension, others to the monetary incentives. Recent experiments have combined these two groups of factors, trying to understand how delegate decision making, under the form of leadership, affect individuals' decisions in intra-groups public good experiments.

These experiments produce evidence of the positive effects of leadership in public good games, suggesting that it is generally beneficial in terms of efficiency to have centralized decisional power in coordination games. Following, I analyze some of these studies, providing general results and presenting a general objective analysis of the literature.

2.4.1 Dataset

In this section, I consider 6 different articles, and a total of 12 studies on leadership in public good experiments (see table 2.3. The number of publications aimed to investigate leadership in public goods is much greater: the ones I use are all suitable in terms of design and aim of the investigation, and allow to perform some general analyses. Other studies are compatible with my investigation but do not include common variables needed (among these Hamman, Weber, and Woon, 2011, that only includes contributions under leadership and not without) for a direct comparisons.

TABLE 2.3: Studies and Treatments

Article	Treatment	Label
Güth et al. (2007)	Fixed Leader	GFL
	Random Leader	GRL
Bolle and Vogel (2011)	Random	BR
	Election	BE
Faillo, Fornasari, and Mittone (2016)	Couple	FCO
	Chat	FCH
Van Vugt and De Cremer (1999)	Instrumental	VI
	Relational	VR
Fleiß and Palan (2013)	Coordinator	FC
	Dictator	FD
Levati, Sutter, and Heijden (2007)	Leader	LL
	Strong Leader	LSL

All experiments are based on public good games where subjects contribute both individually and under a leader's control: this can be more or less binding, depending on the manipulation. The experimental structure is similar across studies, but experimenters vary some factors such as group size, multiplication factor, or leader's election method. In my analysis, I present an overview of the effects of leadership on cooperation, and drive the attention to the common aspects that can be relevant in determining individuals' choices within different experimental designs: these are described in the following section.

In the majority of the studies, the number of leaders' choices observations is quite small. This depends on two main factors: the size of the experimental sample, and the group size. Leaving aside the number of participants, larger group sizes correspond to a smaller number of observations. This causes, for some studies, a large disparity between the number of individual observations and leaders' ones; Van Vugt and De Cremer (1999), for instance, only provide 2 leaders' observations per treatment.

In order to drive a direct comparison across studies, I then use average contribution values, converting them into percentage values. These are computed by taking the average amount invested in the public good and dividing it by the individual per-round endowment given to subjects.

This procedure is repeated for all the experiments considered in the analysis, so that, I obtain 2 values for each study: one related to treatments where subjects take part to the public good game individually, and the other related to treatments with leadership. Once computed these values, I derive the *shift* in contributions generated by the introduction of leadership simply taking the difference between the average percentage contributions with and without leadership.

2.4.2 Contributions to Public Goods

Leadership seems, in general, to affect positively contributions to public good games. In fact, the difference between the average contributions under leadership and the average individual contributions is always positive. Table 2.4 reports the average percentage shift observed in each study.

TABLE 2.4: Studies and Contributions

Label	Individual (%)	Leadership (%)	Shift (%)
GFL	40.16	53.64	13.48
GRL	40.16	79.20	39.04
BR	30.59	39.61	9.02
BE	32.04	54.54	22.50
FCO	48.00	60.00	12.00
FCH	48.00	54.00	6.00
VI	64.67	75.76	11.09
VR	64.12	64.41	0.28*
FC	38.58	92.45	53.87
FD	34.05	89.73	55.68
LL	39.12	57.52	18.40
LSL	39.12	61.68	22.56

* Shift reported by the authors as not statistically significant.

The average percentage individual contribution is equal to 43.22% (sd 10.74%), while, when leadership is implemented, the average percentage contribution grows to 65.21% (sd 15.22%).

Shifts are all positive and have an average percentage value of 21.99%. At a study level, the absolute value of shifts vary from a minimum of 0.28 (Van Vugt and De Cremer, 1999, VR) up to 55.68% (FD). Nevertheless, taking into consideration that the result observed for VR is not statistically significant, it is better to consider as the minimum value the one reported by Faillo, Fornasari, and Mittone (2016) in the *Chat* treatment (FCH), equal to 6.00%.

Thus, all the experimental results considered (exception made for the treatment *random* from Van Vugt and De Cremer, 1999) support what pointed out by Charness and Jackson (2009): the presence of a leader responsible for others systematically increases cooperation and contributions.

2.4.3 Experimental Factors

Although it is not possible to make a pure distinction among factors with positive and negative effects, as the average shifts are all positive, I try to understand if there are observable differences that can be attributed to some common features of the experimental designs used by the authors. Among these features, some are strictly related to the structure of the public good game, others are aimed to manipulate leadership.

Public Good Game Features

I start considering the size of the group taking part to the public good game. Previous studies (Isaac and Walker, 1988 among the others) found evidence of the fact that contributions decrease as the group size increases. Excluding the two studies by Fleiß and Palan (2013), where the number of subjects per group can vary from a minimum of 2 up to a maximum of 10, my dataset contains observations of groups having from 2 up to 6 members. Table 2.5 shows how the average shift changes in correspondence of each group size.

Table 2.5: Group Size Effect

Group Size	Observations	Shift (%)
2	2	9.00
3	2	4.04
4	4	23.37
6	2	5.69

Groups of 2 members have an average shift that is quite high if compared to groups of size 3 and 6; the average shift corresponding to group of 4 members is much higher than others. In general, my results seem not to be in line with previous findings, as it is not possible to find a specific relationship between group size and contributions (i.e. as group size increases, contributions decrease).

Multiplication factors across studies are quite homogenous: Bolle and Vogel (2011) applied an α equal to 1.5, Levati, Sutter, and Heijden (2007) used a 1.67, while all the remaining experiments have an α of 1.6.

Levati, Sutter, and Heijden (2007) is also the only experiment applying a threshold to allow the provision of the public good, and the only experiment where subjects make decisions over real money rather than on experimental currency units.

Altruistic punishment is present in three studies (FCO, FCH, VI), and the average shift is 9.70%; in other studies without punishment this value is equal to 26.09%. This reduction in the shift is quite surprising as, in general, altruistic punishment should increase and sustain cooperation. Findings presented by Faillo, Fornasari, and Mittone (2016) explain that subjects, when responsible for others, tend to overuse punishment reducing cooperation and final payoffs. Nevertheless, in the studies analyzed it is possible to observe a different tendency: altruistic punishment under leadership seems to reduce average cooperation. Yet, taking into account the small size of the sample and the fact that others experimental factors are left aside, this conclusion cannot be generalized, but has to be considered only referred to the context of this analysis.

In every study, subjects had to play for a defined number of rounds, varying from 8 to 33. Table 2.6 reports a classification of the number of rounds observed across experiments, together with the associated number of observations and the average shift.

Table 2.6: Number of Rounds

Rounds	Observations	Shift (%)
8	2	5.69
16	4	23.37
20	4	31.89
33	2	15.76

There seems to be a trend for studies with a number of rounds ranging from 8 to 20: the higher the number of rounds, the higher the average shift in contributions; the maximum average shift in in correspondence of 20 rounds and it is equal to 31.89%. For the two observations corresponding to 33 rounds, this is not true: the average shift is equal to 15.76%. One interpretation could be that, when the number of rounds is too large (probably larger than 20), leaders lose perception of the responsibility they have and decrease contributions for their group.

Leadership Features

I now drive the attention to the factors aimed to manipulate leadership: my starting point is the way in which leaders are appointed.

Almost in every study, leaders are appointed randomly, with the only exception being the treatment *election* by Bolle and Vogel (2011). Here, the authors implemented an election method that allowed group members to appoint their own leader. In terms of average shift, this corresponds to a value of 22.50%, which is similar to the average shift for the remaining part of the sample, equal to 21.95%.

In seven studies, appointed leaders have dictating power (i.e. they can decide how much to contribute for their groups); in the remaining five studies, leaders are either first movers that followers can imitate or advisors with strictly limited powers. Despite this difference in leaders' power, average shifts under the two conditions are 21.77% for dictating leaders, and 22.30% for other leaders, suggesting that the general increase in contributions observed could not depend on the type of leadership implemented.

In both the studies by Van Vugt and De Cremer (1999), leaders were appointed taking people from outside the group, obtaining an average shift of 5.69%; this value is much lower with respect to the one obtained when leaders are group members, which is equal to 25,26%. Nevertheless, it is important to remind that the shift in contributions observed in one of the treatment Van Vugt and De Cremer (1999) (VR) is not statistically significant; thus it is not possible to derive a conclusion from this comparison.

Three studies implemented a leadership based on a shuffle structure: i.e. the person leading the group changed more than once during the implementation of the game; this happened in the experiments conducted by Bolle and Vogel (2011) and by Güth et al. (2007) (specifically, in the treatment *random leader*). The average shift in contributions deriving from the implementation of leadership in these experiments is equal to 23.5%. On the other hand, when the leader is appointed at the beginning of the experiment and stays in charge until the end of the last round, the average shift is equal to 21.4%.

2.4.4 Discussion

Based on my dataset, the effects of leadership in public good games seems to be generally positive; in fact, it is possible to observe how average contributions in treatments with individual choices are always lower than contributions driven by leadership.

Some features of the public good game setting could cause differences across studies: the size of groups, the implementation of altruistic punishment, and the number of rounds.

Previous studies on public good games found evidence of a negative relationship between the size of groups and average contributions. In my analysis, there seems to be a similar trend, but when groups are made of 4 people contributions are much higher than in any other case. I find another trend in correspondence of the number of rounds: in this case, the relationship between repetitions and contributions is positive until the number of rounds is equal to 20; for larger numbers I observe a decrease in contributions.

Unexpectedly, altruistic punishment under leadership corresponds, in my analysis, to a decrease in contributions. Average shifts are still positive, so the effects of leadership are not completely jeopardized, but values are lower with respect to studies where punishment is not implemented.

In line with what found by Levati, Sutter, and Heijden (2007), the election method implemented to appoint groups leaders does not seem to affect average shifts in contributions; similarly, making a distinction between the types of power leaders are given is not relevant; nevertheless, it is important to specify that I only distinguish between dictating and non-dictating powers. On the other hand, when leaders do not belong to the group, the increase in contribution is quite low, even if still positive.

2.5 Conclusions

The analysis presented in this study focuses on three diverse dimensions of decision making: dictator games, delegated decision making, and leadership in cooperation. Regarding the first dimension, I provide an overview of the literature following the exhaustive meta-analysis by Engel (2011): the author finds that the average share of endowment dictators allocate to their recipients is equal to 28.35%.

Among the principal determinants of dictators' willingness to give, it is possible to recognize factors with a positive impact on the amount given by the dictator, such as the presence of deserving recipients, multiple recipients, old dictators, or recipients who earned their shares. At the same time, other factors affect dictators' choices negatively: decisions made by groups of dictators, games played repeatedly, recipients already owning an endowment, low degrees of social proximity, and young dictators.

As explained by Engel (2011), dictator games have a simple structure but, depending on the experimental setting and on the pool of subject, produce a multiplicity of results that generates an overall complex frame; for these reasons, it is not possible to generalize results in this literature, but it is possible to use them as tools to explore humans' preferences and their heterogeneity of choices in simple giving tasks.

The second investigation focuses on delegated decision making under risk, and analyzes individuals' risky decisions made over own and others' money. A possible explanation to discrepancies in results across experiments could be provided by the fact that authors use different risk elicitation methods. In particular, it seems that both the BDM and the GP procedure generate results going in the same direction, while other elicitations produce somehow contradicting findings, which might be object of further experimental tests.

Following the exercise conducted by Crosetto and Filippin (2015), I was able to translate risk preferences obtained in experiments using the HL and GP into a common scale: results are then compared to average values found in the literature. In general, the GP reports degrees of risk aversion and discrepancies between self and delegated decision making that seem to be lower than the ones observed using the HL. Nevertheless, it is important to remind that in the HL the categorization is discrete, while the GP provides a continuous measure. Furthermore, the difference in the range of risk preferences captured by the each task plays a determinant role.

I conclude my analysis moving to the third dimension, leadership in cooperation. Some of the studies in this field could be, from a point of view, associated to delegated decision making and cooperation; in fact, when someone is appointed as leader of a group, and she has the power to decide how much the group he is responsible for should contribute to the public good (i.e. he has dictating powers), her is similar to the one of a delegated agent; the main difference is that, when taking part to a public good game, subjects do not bear a defined degree of risk, but they are asked to decide under strategic interaction.

In general, the implementation of leadership seems to generate an increase in the average contribution to the public good. Normalizing experimental results, I find no evidence of any negative effect derived from the presence of group leaders, being this a coordinator, an advisor, or a pure dictator. The main reason could be leaders and followers' aligned monetary incentives, together with the moral pressure generated by the responsibility for others.

In addition to this, the majority of the common factors I observed across studies do not seem relevant for determining the shift in contributions (from traditional public goods to public goods with leaders). From the point of view of leadership, I only observe a decrease in the shift, which still remains positive, when appointed leaders are not group members; similarly, it is possible to observe a reduction in the increase of contributions when some features of the public good game structured are manipulated: altruistic punishment, the size of groups (exception made for group of 4), and a number of repetitions greater than 20. Nevertheless, my study mainly focus on the differences between individual contributions and those observed under leadership; in order to obtain a more precise analysis of the features strictly related to leadership, it would be required to include a larger number of observations and use a specific categorization.

To conclude, what emerges from my analysis is similar to the general findings pointed out by Engel (2011). Experimental evidence on decision making where individuals are responsible for determining their own and others' payoffs generates a great heterogeneity of results. These seem to be, in many cases, caused by differences in the experimental design adopted, others, or by the demographic factors characterizing the pool of subjects taking part to the experiment.

For these reasons, experimental results from single experiments should not be generalized; nonetheless, they can be considered reliable if referred to a defined context. Furthermore, controlling for specific experimental and demographic factors, experiments on decision making can be used to isolate and investigate other determinants of individuals' socially oriented behavior.

Chapter 3

Investment in Risk Protection and Social Preferences: An Experimental Study

with Matteo Ploner and Ivan Soraperra [1]

3.1 Introduction

Everyday life provides many examples of how we care for others' welfare: think of how many people are willing to give up part of their time and resources in order to help those in need. To a greater extent, these types of actions are not driven by any specific material incentive or reward. Rather, they depend on our concern for other individuals.

Previous experimental studies about other-regarding concerns mainly focused on interactions in which the consequences of actions are deterministic, like in the dictator game (for a review see Engel, 2011). Here we extend the inquiry of other-regarding concerns to environments in which the link between actions and consequences is governed by chance.

Our study focuses on how individuals manage own/others' resources to offset risk affecting themselves/others. Specifically, we study how individuals trade-off own/other resources to offset risk affecting themselves. Furthermore, we study choices under risk when these affect someone else and have no direct material consequences for the decision maker.

As such, this paper relates to two well-established research streams in economics: decision making under risk/uncertainty and social preferences. On the one hand, it has been widely documented that people display certain preferences and attitudes toward risk. As an example, Andersen et al. (2006)

[1] Thanks to Dr Jacob Seifert for his precious proofreading and for the good time shared in room 53. I'm thankful.

demonstrates that subjects taking part in laboratory experiments tend, in general, to be risk averse. On the other hand, widespread other-regarding concerns have been identified in field and lab experiments (e.g., Camerer, 2013). Several motives for other-regarding behavior have been put forward in the literature. We focus here on two outcome-based motives, namely inequity aversion (e.g., Fehr and Schmidt, 1999) and efficiency concerns (e.g., Engelmann and Strobel, 2004).

Several studies have given joint consideration to risk and social preferences in experimental settings (for a review of early works see Trautmann and Vieider, 2011). Güth, Levati, and Ploner (2008) shows that individuals evaluate risk borne by others less negatively than risk borne by themselves. Krawczyk and Le Lec (2010) shows that individuals make choices that are generally socially and efficiency-oriented when these are in the domain of risk. Evidence collected by Lahno and Serra-Garcia (2015) suggests that when choosing among risky prospects, individuals show equity concerns, i.e. individuals select their risk exposure to avoid being worse off than someone else, once risk is resolved.

Another relevant stream of research is that of *delegated risky decision making*, i.e. a situation in which one party chooses the amount of risk another party has to bear, without any material incentive linking the choice of the decision maker to the outcome of the risky prospect. Within this domain, Agranov, Bisin, and Schotter (2014) provide evidence of what the authors define as the *Other People's Money* effect, i.e. other people's money is invested with much lower degrees of risk aversion than is agents' own money. Also Andersson et al. (2014) find that, when deciding for others, people are on average less risk averse, mainly because of a reduction in loss aversion produced by the usage of others resources. Chakravarty et al. (2011) interprets the shift in risk preferences as originating in biased beliefs about other people's preferences. Results reported by Eriksen and Kvaløy (2014) contrast with the evidence reported above, as participants in the experiment display a higher risk aversion with respect to people's money than their own. Further, evidence of a composite pattern in delegated risky decision making is reported by Pahlke, Strasser, and Vieider (2015). The study suggests that individuals are more risk averse with others' money in the domain of gains, but less risk averse in the domain of losses.

In spite of the lack of consistent results concerning risk propensity, studies on delegated decision making show a general tendency: individuals decide differently when using others' money rather than their own. To explain observed behavior, most of the studies mentioned above focus on the risk preferences of the decision maker and on their beliefs about the risk preferences of the counterpart. We suggest here that taking social preferences into account may provide a better understanding of behavior, helping to explain these apparently conflicting results. We test this intuition using the simple model of social preferences introduced by Charness and Rabin (2002), with the aim of providing an alternative to risk preferences as the only explanation to discrepancies in self and other-oriented decision making under risk.

We present a modified dictator game to test how much subjects are willing to pay to offset risk for themselves and for someone else, using either their own money or someone else's money. We focus on two specific types of subjects in terms of social preferences: difference-averse, and welfare-enhancing. Both types make delegated decisions that are consistent with higher degrees of risk aversion when the subject's own money is at stake. In addition to this, we observe that individuals having access to others' resources use these in order to protect themselves from risk. Furthermore, we find evidence of altruistic behaviors: subjects show a willingness to use their own wealth to buy protection for others. Overall, our results emphasize the importance of social preferences when risky choices have social spillovers.

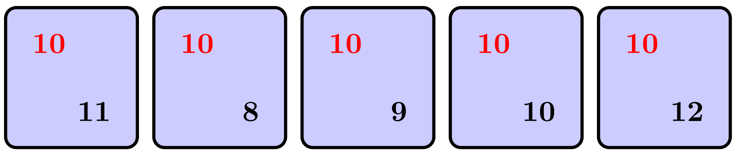
3.2 Methodology

3.2.1 Task

During the experiment, subjects are asked to perform a dictator game-like task and are assigned to two roles: decision maker (dictator) and passive player (recipient). Dictators are shown five cards on a computer screen, each one associated to a different payoff allocation for themselves and for the recipient. Dictators are asked to choose the one they prefer to determine the payoff for themselves and for the recipient they are paired with. Knowledge about the payoffs is experimentally manipulated.

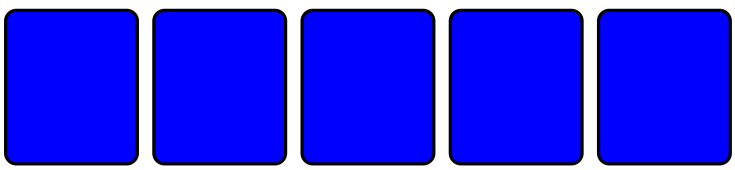
The experiment is divided into two parts. In part 1, the five cards are displayed face-up, each card reporting two outcomes in euro (see Figure 3.1). The value in the upper left corner of the card represents dictator's payoff (π_y), while the value in the lower right corner represents recipients' payoff (π_x). In part 1, the dictator's payoff is always equal to 10 euros, while the recipient's payoff can vary between 8 euros and 12 euros, so that the set of possible outcomes is $\Pi : \{(8, 10), (9, 10), (10, 10), (11, 10), (12, 10)\}$. Dictators choose the card they prefer and then proceed to the second part of the experiment.

FIGURE 3.1: Cards Face-up



In part 2, five cards are displayed, each implying a particular monetary outcome for both the dictator and the recipient, as in part 1. However, unlike in part 1, the cards are face-down and payoffs associated to each card are not known to the decision maker (see Figure 3.2). However, the distribution of outcomes for the dictator (π_y) and for the other is common knowledge (π_x), as explained in Section 3.2.2. Therefore, unlike in part 1, dictators face a genuinely risky choice.

FIGURE 3.2: Cards Face-down



Before making a blind choice, dictators have the option to turn over the five cards by participating in a lottery. This is implemented through a BDM procedure (Becker, DeGroot, and Marschak, 1964). Dictators post a monetary offer $0 \leq b \leq 6$ that represents their willingness to pay (WTP) to turn over the cards. We take this WTP as a direct measure of investment in risk protection.

After offers are made, a random value $0 \leq r \leq 6$ is drawn from a uniform distribution, so that all the values in the interval have the same probability of being extracted. If the random value drawn is smaller than, or equal to, the value offered by the subject ($r \leq b$), all five cards are turned and r is the price paid to resolve the uncertainty. If the random value drawn is higher than the value offered by subjects ($r > b$), the cards are not turned and no price is paid.

Once the procedure is over, the dictator chooses one of the five cards, either face-up or face-down, according to the outcome of the BDM procedure.

3.2.2 Treatments

As shown by Table 3.1, two factors are experimentally manipulated. The first factor, manipulated in a between-subjects fashion, is the identity of the subject bearing the cost of the bid ($Cost$). Depending on the treatment, the cost is deducted from either the dictator's payoff ($Cost.Self$) or from the recipient's payoff ($Cost.Other$).

The second factor we manipulate, this time in a within-subjects fashion over two distinct rounds of part 2, is the identity of the individual bearing the *risk* of a choice made with face-down cards ($Risk$). Specifically, in one round the dictator's payoff is always equal to 10 euros and recipient's payoff can be either 8, 9, 10, 11 or 12 euros, depending on the card chosen ($Risk.other$)). In this case, the recipient is the subject bearing the risk, while the dictator faces a safe payoff equal to the expected value of the recipient's risky payoffs. In the alternative round, the recipient's payoff is fixed at 10 euros, while the dictator bears the risk of getting either 8, 9, 10, 11 or 12 euros, with equal likelihood. The order of the phases was administered to balance the number of dictators and recipients bearing the risk in Phase 1, thus controlling for potential order effects.

TABLE 3.1: Table of Treatments and labels adopted.

		Risk	
		Self	Other
Cost	Self (N = 76)	CS/RS	CS/RO
	Other (N = 80)	CO/RS	CO/RO

3.2.3 Participants and Procedures

The experiment was conducted at the Cognitive and Experimental Economics Laboratory (CEEL) of the University of Trento. Participants were recruited among undergraduate students. The experiment was programmed and conducted using z-Tree software (Fischbacher, 1999). We conducted 8 experimental sessions and a total of 156 subjects took part in the experiment. Each subject received a €3.00 show-up fee, plus a sum that varied depending on their performance in the experiment. This was, on average, equal to €10.13.

Upon their arrival, subjects were randomly assigned to a computer and received instructions for the experiment.[2] Subjects had 5 minutes to read the general instructions and those related to the first part of the experiment, then these were read aloud by one of the experimenters. Once all subjects successfully answered a comprehension test, the experiment started.

Choices were collected via a vector strategy method.[3] Initially, all participants were assigned to the role of dictator. The software randomly paired subjects, and they did not know who they were paired with. Subjects all expressed their decisions as dictators and, only at the end of the experiment, before the determination of final payments, they were randomly divided into dictators and recipients. Note that participants were made aware that the choices of those assigned to be recipients did not affect the final payment.

Once subjects complete part 1 of the experiment, they were given two minutes to read the instructions for part 2. Then, an experimenter reads them out again and answered questions, when needed. Subjects completed a short comprehension questionnaire and then the second part of the experiment started.

Once subjects completed the second part of the experiment, they were randomly assigned the role of dictator or recipient, and they received feedback about the three cards chosen during the experiment (one in part 1 and two in part 2), either by themselves or by the dictator they were paired with. The software randomly drew one of the three choices to determine the final

[2] An English translation is available in the appendix.

[3] This choice was mainly driven by the experiment budget. We are aware of the fact that such a procedure has been criticized because it creates uncertainty on the effective roles of participants; nevertheless, Brandts and Charness (2011) provide prove of its efficacy.

payment, thereby ending the experiment. This protocol is called "pay-one-at-random" and, despite it induces a meta-lottery in the experiment, it is considered a commonly accepted procedure. Experimental results can be affected when predictions are based on Rank Dependent Utility: considering that our experiment relies on Expected Utility, we believe the payment procedure won't have consequences on our study.

Before being paid, subjects were asked to answer two sets of questions.[4] The first was composed of eight questions extracted from the Levenson's IPC scale (Levenson, 1972) and produced a measurement of subjects' locus of control. The higher the score, the more subjects think events in their life depend on their own actions. The second questionnaire was composed of seven questions extracted from the Domain-Specific Risk-Taking (DOSPERT) Scale (Weber, Blais, and Betz, 2002), which measures subjects' risk attitudes. [5] We acknowledge that, from a psychological point of view, information we gather through these questionnaires is limited by the fact that it is retrieved via non-validated protocols. However, given time restrictions, we had to rely on excerpts of the original questionnaires.

3.2.4 Behavioral Predictions

Risk-free choices in part 1 allow us to classify individuals in terms of their social preferences. In so doing, we rely on the following specification of the model by Charness and Rabin (2002)(henceforth CR):

$$CR_y(\pi_x, \pi_y) = \begin{cases} (1-\rho)\pi_y + \rho\pi_x & if \quad \pi_y \geq \pi_x \\ (1-\sigma)\pi_y + \sigma\pi_x & if \quad \pi_y < \pi_x \end{cases} \tag{3.1}$$

where CR_y is the utility of a player Y, ρ and σ capture the concern for other's welfare, π_x and π_y are respectively player X and player Y's payoffs. Depending on the payoff that dictators allocate to recipients, dictators can be assigned to the following three main categories: welfare-enhancing (WE), competitive (CP), and difference-averse (DA).[6] The model unambiguously predicts WE types to choose the highest outcome for the other (i.e., $\pi_x = 12$),

[4] An English version of the questionnaires is included in the appendix.

[5] The seven sample questions we extracted from the 30 questions DOSPERT questionnaire were chosen according to the focus of our research, and consist of four questions related to the financial domain and three related to the social one.

[6] Types are characterized by distinct parameters constellations. For welfare-enhancing we have that $1 \geq \rho \geq \sigma > 0$; for difference-averse we have that $\sigma < 0 < \rho < 1$.

DA types to choose the intermediate outcome (i.e., $\pi_x = 10$), and CP types to choose the lowest outcome (i.e., $\pi_x = 8$). Strictly selfish types do not have any preference as far as the other's payoff is concerned; thus, they are assumed to be randomly distributed among the five outcomes.

Based on model 3.1, we present here predictions about bid levels in alternative experimental conditions in part 2 of the experiment. The full derivation of our predictions is reported in Appendix 3.6. We rely on the assumption that the decision maker maximizes her CR's expected utility. In addition to the standard assumptions of the model, we assume that $\rho \leq .5$, which implies that the individuals value their own utility more than the utility of the other when they are better off than the other. For the sake of simplicity, we rely on the original, (piece-wise) linear model specification. While the curvature of the utility function is a relevant factor in choices like those considered here, we maintain that the linear specification provides us with a satisfactory approximation of the actual preference structure.

Under these assumptions, we obtain a full rank of optimal bids in the 4 alternative conditions: $b^*_{CO/RS} \geq b^*_{CO/RO} \geq b^*_{CS/RS} \geq b^*_{CS/RO}$. Thus, irrespective of their type in the CR model, decision makers will post higher bids when the cost is borne by the other than when the cost is borne by themselves. In fact, when the cost is borne by subjects themselves, we have that $b^* \leq 2.6$ and, when the cost is borne by another, we have that $b^* > 2$.

In the light of these predictions, we proceed to test the following two Hypotheses, which consider the way decision makers manage the shifting of costs and risks between themselves and the experimental other.

Hypothesis 3.1 *Risk borne by dictators.*
When risk is borne by the dictators, they invest more in risk protection when the cost of the investment is borne by the other than when it is borne by themselves ($b^*_{CO/RS} > b^*_{CS/RS}$).

Hypothesis 3.2 *Cost borne by dictators.*
When the cost of investing in risk protection is borne by the dictators, they are investing more in risk protection when risk is borne by themselves than when it is borne by the other ($b^*_{CS/RS} > b^*_{CS/RO}$).

Our model predicts that individuals address risk differently when risk and costs are entirely born by themselves (CS/RS) rather than the other (CO/RO). In particular, as summarized below, our model provides us with clear-cut guidance as to how individuals behave in a setting of delegated decision making under risk, depending on whether they are choosing for others with others' resources, or choosing for themselves with their own resources.

Hypothesis 3.3 *Delegated risky choice.*
Dictators are going to buy more risk protection when risk and costs are borne by the other than when risk and costs are borne by themselves ($b^*_{CO/RO} > b^*_{CS/RS}$).

The model also provides us with testable predictions about how investment in risk protection differs according to an individual's social preference type. Under the assumption that DA and WE share the same ρ, DA are predicted to post higher bids than WE in all conditions but CS/RO. In this case, b^* is decreasing for $\sigma < 0$ and increasing for $\sigma > 0$ and this complicates the comparison between the two types; we have $\sigma < 0$ for the DA and $\sigma > 0$ for the WE. Furthermore, the difference in bids between condition CS/RS and conditions CO/RS, CO/RO should be larger for DA than for WE.

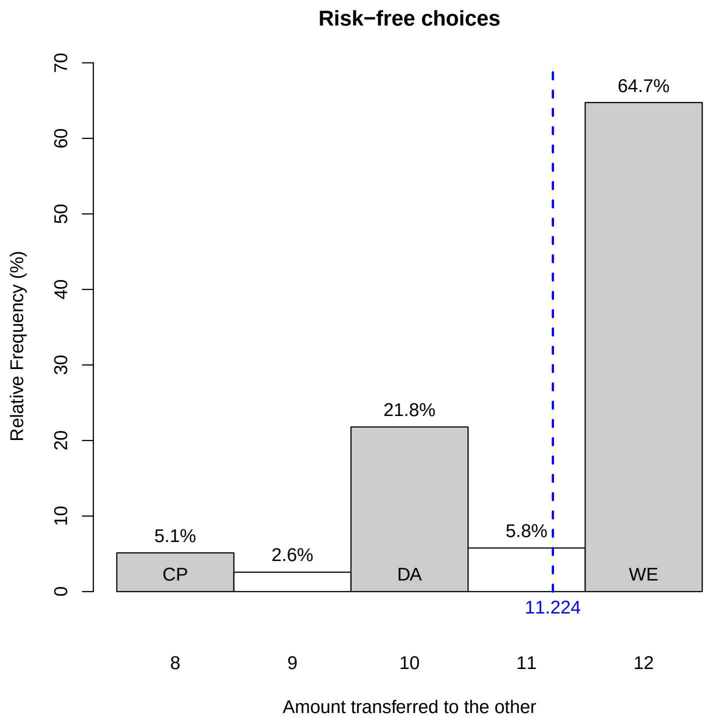
Hypothesis 3.4 *Risk protection and social types.*
Overall, DA types are going to buy more risk protection than WE types ($b^*_{DA} > b^*_{WE}$).

3.3 Results

3.3.1 Classification of Social Types

Figure 3.3 displays the distribution of choices in part 1, when cards are face-up and there is no uncertainty. Darker bars refer to participants that fall under a specific social type categorization, according the CR model presented above. Those giving 8, 10, and 12 can be identified with the competitive (CP), difference-averse (DA), and welfare-enhancing (WE) types, respectively.

FIGURE 3.3: Distribution of Social Preferences Types



As Figure 3.3 highlights, the large majority of choices is observed in correspondence to the maximum transfer ($\pi_x = 12$) to the other participant (64.7%). Intermediate transfers ($\pi_x = 10$) and minimal transfers ($\pi_x = 8$) capture the 21.8% and 5.1% of choices, respectively. This results in sustained average transfers (=11.2), close to the maximum of 12.

3.3.2 Investment in Risk Protection

Figure 3.4 presents the willingness to pay (WTP) distribution in the four experimental conditions of part 2. A higher WTP signals a higher attraction for the safe environment of choice relative to the uncertain one. Boxplots capture quartiles of the distributions and circles provide a representation of the frequency of each choice, with the radius of the circle proportional to the number of choices observed for a given level of WTP. Bold lines and numbers identify median and average choices, respectively.

FIGURE 3.4: Distribution of WTP across Conditions

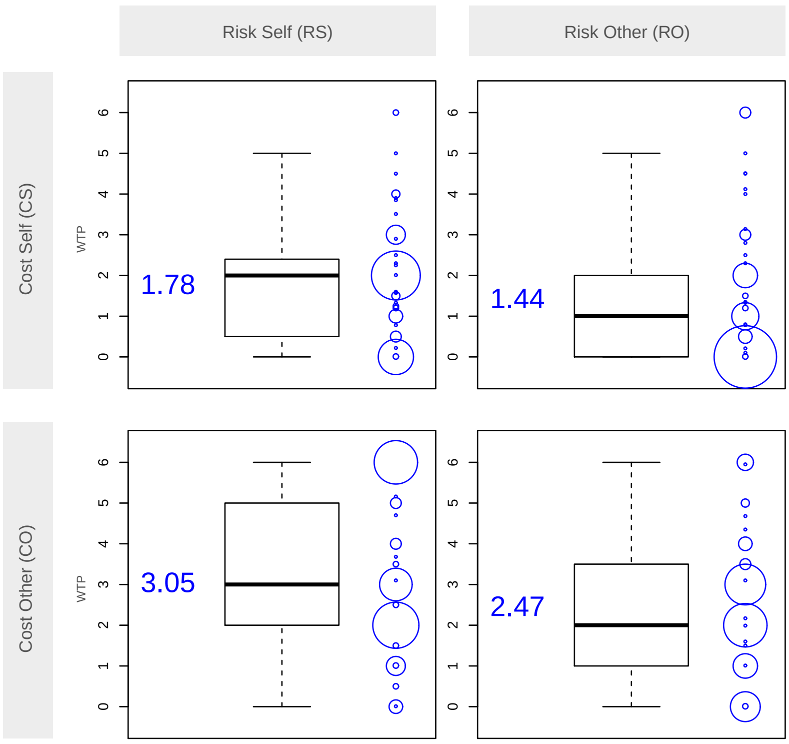


Figure 3.4 shows that the highest average (median) bid is observed in condition CO/RS and that the lowest is observed in condition CS/RO. The figure provides full support to the predictions of section 3.6, with bids in alternative conditions reflecting hypothesis obtain from the CR model : $b^*_{CO/RS} \geq b^*_{CO/RO} \geq b^*_{CS/RS} \geq b^*_{CS/RO}$.

The model also predicts that bids are going to be lower than or equal to 2.6, when the cost is borne by the dictator. Non-parametric tests show that this is the case both in condition CS/RO and in condition CS/RS (WST both p-values < 0.001).[7] In contrast, when the cost is borne by the other, bids should be above a lower bound of 2. Non-parametric tests again support the predictions, both in condition CO/RO and in condition CO/RS (WST, both p-values < 0.037).

Choices in condition CO/RS show that, when participants use the other's resources to protect themselves from risk, they choose a positive WTP (WST, p-value< 0.001). However, in contrast to what selfishness would predict, the

[7] All tests reported are two-sided, when not specified. WRT stands for Wilcoxon Rank Sum Test. WST stands for Wilcoxon Signed Rank Test.

central tendency of the distribution is different from the maximum amount of 6 (WST, p-value$<$ 0.001).

An interesting measure of the degree of "opportunism" shown by subjects is given by the difference between WTP in CO/RS and CS/RS. According to a non-parametric test, the positive difference between the two conditions is statistically significant (WRT, p-value$<$ 0.001).

Result 3.1 *The dictators invest more of the other's resources than of their own resources to protect themselves from risk.*

Choices in condition CS/RO inform us of the degree of concern for risk affecting the other when own resources are at stake. In contrast to what is predicted by pure selfishness, the average level of WTP in this condition is different from zero (WST, p-value$<$ 0.001). Nevertheless, individuals seem to value risk more when this affects themselves than when it affects the others, as confirmed by a non-parametric test (WST, p-value=0.008).

Result 3.2 *The dictators invest more of their resources in risk protection when risk is borne by themselves than when it is borne by the other.*

The comparison between condition CS/RS and condition CO/RO suggests that our participants tend to attach a higher negative value to risk when the cost of offsetting it and the consequences of choices are borne by others than when they are borne by themselves. Indeed, a comparison of the two conditions shows that the WTP in the latter is statistically higher than in the former (WRT, p.value=0.014).

Result 3.3 *The dictators invest more in risk protection when delegated to choose for others than when choosing for themselves.*

3.3.3 Risk Protection and Social Types

Table 3.2 reports summary statistics about WTP choices in alternative experimental conditions and for the two most common social types: difference-averse (DA) and welfare-enhancing (WE).[8]

As Table 3.2 shows, the highest average (median) bid is observed in condition CO/RS for the DA types, while the lowest average (median) bid is

[8] In the analysis below we omit CP because of the low number of observations collected (i.e., 8) for this social type.

TABLE 3.2: Risk Protection and Social Types

	DA			WE		
	Mean	Median	SD	Mean	Median	SD
CS/RS	1.639	2.000	1.171	1.791	2.000	1.589
CS/RO	1.227	0.800	1.543	1.403	1.000	1.698
CO/RS	4.097	4.000	1.736	2.685	2.000	1.903
CO/RO	3.226	3.000	1.937	2.086	2.000	1.596

observed in condition CS/RO for the WE types. When comparing bids of the DA and the WE, the largest positive difference in average bids is observed in condition CO/RS. The smallest difference is registered in condition CS/RO. In line with predictions obtained above, the difference between the DA and WE in condition CS/RO is small and negative.

A series of non-parametric tests shows that no significant differences between the two types are observed in conditions in which the decision maker has to pay for protection from risk, CS/RS and CS/RO (WRT, both p-values $> .650$). In contrast, in the conditions in which the other pays for protection, i.e. CO/RS and CO/RO, the DA types tend to systematically buy more protection from risk (WRT, both p-values< 0.032)

Result 3.4 *DA types tend to invest more of the other's resources in protection from risk than WE types.*

Further insights about the consistency of behavior of alternative social types are gathered from the payoffs of those facing risk in part 2 when the bid is successful and cards are turned face-up. In such a condition, when the decision maker is a DA type the average payoffs are equal to 11.451 and 9.392 for the decision maker and the recipient, respectively (diff=2.059). When the decision maker is a WE type, the average payoffs are 11.406 and 10.864 for the decision maker and the recipient, respectively (diff=0.542). Non-parametric tests on individual averages show that the two types differ statistically in the payoffs of the recipients, but not in own payoffs (WRT, p-value=0.008 and p-value=0.836, respectively). As expected, a much wider gap in ex-post payoffs within a couple is registered when the decision maker is a DA type and this confirms the relevance of outcome-based considerations, even when the choice in part 2 is risk free.

3.3.4 Regression Analysis

Table 3.3 reports on the regression outcomes of a Linear Mixed Model estimation. The estimates are restricted to individuals classified as DA or WE (135 individuals). The dependent variable in the model is given by WTP, a direct measure of investment in risk protection. Model 1 controls for the impact of treatments on the decision to invest in risk protection. The treatment dummy CS is equal to 1 when cost of the investment is borne by subjects themselves and 0 when it is borne by the other. The treatment dummy RS is equal to 1 when risk is borne by self and 0 when it is borne by the other. The impact of the two variables is estimated both in isolation and in interaction. In Model 2, we add a control for social types and introduce the dummy variable *type.DA*, equal to 1 when an individual is classified as difference-averse, as deduced from choices in the first task, and equal to 0 when classified as welfare enhancing. The dummy variable *type.DA* is also interacted with treatment dummies. Finally, in Model 3 we add additional controls for demographic characteristics (*Age* and $Female$), for field of study (*Econ* is equal to 1 if students of Economics and 0 otherwise) and for self-reported measures in the DOSPERT questionnaire and in the Levenson's IPC scale. According to the Akaike's Information criterion (AIC), the most efficient specification is that of Model 2.

As the estimates of Model (1) show, dictators invest less in risk protection when the cost is borne by themselves rather than by the other ($CS = -1.026$). In contrast, more protection is bought when risk affects the dictator rather than the other ($RS = 0.671$). This pattern is consistent with Results 1 and 2 reported above. Furthermore, the linear hypothesis test $CS + RS + CS : RS = 0$ (Chisq=4.517, p-value=0.034) shows that participants tend to invest less in risk protection when choosing for themselves than when delegated to choose for others. This confirms what is reported above in Result 3.

Model 2 takes into account the impact of treatment dummies, controlling for social preferences. According to the results of Model 2, difference-averse types tend to invest more in risk protection than welfare-enhancing types (*type.DA* $= 1.140$), when cost and risk are borne by the other. Furthermore, the negative impact of CS on the investment is (marginally) stronger for the DA, as shown by the estimated coefficient for the interaction term CS :

TABLE 3.3: WTP Determinants (LMM Regression)

	Model 1	Model 2	Model 3
(Intercept)	$2.387\ (0.203)^{***}$	$2.086\ (0.232)^{***}$	$4.397\ (1.765)^{*}$
CS	$-1.026\ (0.298)^{***}$	$-0.683\ (0.336)^{*}$	$-0.647\ (0.337)^{\circ}$
RS	$0.671\ (0.214)^{**}$	$0.599\ (0.251)^{*}$	$0.599\ (0.251)^{*}$
$CS : RS$	$-0.277\ (0.313)$	$-0.212\ (0.364)$	$-0.212\ (0.364)$
$type.DA$		$1.140\ (0.451)^{*}$	$1.087\ (0.462)^{*}$
$CS : type.DA$		$-1.316\ (0.672)^{\circ}$	$-1.430\ (0.676)^{*}$
$RS : type.DA$		$0.271\ (0.488)$	$0.271\ (0.488)$
$CS : RS : type.DA$		$-0.246\ (0.728)$	$-0.246\ (0.728)$
Age			$-0.018\ (0.052)$
$Econ$			$-0.455\ (0.261)^{\circ}$
$Female$			$0.060\ (0.267)$
$DOSPERT.score$			$-0.016\ (0.027)$
$LEVINSON.score$			$-0.042\ (0.034)$
AIC	1044.105	1039.642	1060.882
Num. obs.	270	270	270
Num. groups: ID	135	135	135

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\circ}p < 0.1$

$type.DA$. Thus, DA types are more likely to exploit others' resources to invest in risk protection than WE types, in line with Result 4.

Estimates of Model 3 are, overall, in line with the results of Model 2. Among the control variables, only the field of study has a (weakly) significant effect on investment propensity, with students of economics investing lower amounts in risk protection than others.

3.4 Discussion and Conclusions

Outcomes from our experiment shed new light on three fundamental questions about risky decision-making involving social spillovers: i) do individuals use more resources to offset risk when accessing others' resources rather than own resources? ii) Do individuals use more resources to offset risk borne by themselves rather than by others? iii) Do individuals offset risk differently when choosing for themselves rather than when delegated to choose for others?

To answer these questions, we assess behavior in a simple experimental task against predictions obtained from a manageable and well-known model for social preferences.[9] Results obtained provide strong support to the predictive ability of the model in the context under investigation. Specifically, we show

[9]Note that we rely on the model by Charness and Rabin, 2002: this was one of the first models for Social Preferences.

that individuals buy more risk protection when another provides the resources (i) above), but are less likely to invest own resources to protect others than to protect themselves (ii). Furthermore, decision makers seem to invest more in risk protection when delegated to choose than when choosing for themselves (iii).

We show that differences in investment in risk protection across individuals are largely predicted by their social preference attitudes, with difference-averse types generally investing more resources in risk protection than welfare-enhancing types. This is mainly due to the fact that individuals endowed with inequity averse preferences dislike the perspective of lagging behind others (Linde and Sonnemans, 2012).

Our study highlights the importance of allocational considerations in risky choices involving others' welfare.[10] In a typical delegated risky choice, the decision maker has no stakes in the choice. Thus, standard self-centered utility models do not provide clear guidance in predicting behavior. In addition to this, even allowing for other-regarding concerns, it would not be possible to define precisely what curvature of the utility function should be applied to the other. Here we neglect considerations about the curvature of the utility function and specifically focus on other-regarding concerns. This provides us with clear-cut predictions which are, overall, confirmed by the data gathered in the course of the experiment.

While there is scope for further research in this area to enrich the picture by modeling tastes for risk more explicitly, we feel that the evidence presented here nonetheless represents an important step along this research path.

[10] Note that we refer to a two-players game and to our specific experimental structure: at this stage, it is not possible to generalize our conclusions to a multiple-players structure.

3.5 Appendix - Experimental Instructions

Following we include an English translation of the experiment instructions. In order to match our experimental design, we had the need to produce four different version of the instructions (i.e. one for each treatment). General instructions and Instructions for the first part of the experiment were common for all the four treatments, while instructions for the second part were suitably edited.

As explained in the section on the experimental design, two treatments, i.e. the ones related to the risky component (*Risk*), are applied within subjects. This means that steps in the instructions referring to these treatments were common to the four versions. Nevertheless, we introduced a variation in the instruction to control for the order bias.

Here we present a version containing the edited parts. Every time we will be referring to one of these, there will always be a label between squared brackets indicating to what treatment the step refers to. Labels can either refer to the treatment related to the money used to buy the right to turn the cards, or to the order according to which participants, depending on their roles, bear the risk of receiving n unknown payment during the two phases in the second part of the experiment.

In the first case, if we refer to the treatment in which *Participant 2* has to be charged of the eventual cost of turning the cards you will read the label [$Cost.Oth$], while if we refer to the treatment in which *Participant 2* has to be charged of the eventual cost of turning the cards you will read the label [$Cost.Own$].

Similarly, when describing the two phases in the second part of the experiment, if *Participant 1* is the first to bear the risk of receiving an unknown payment you will read the label [$Risk.Own_first$], while if *Participant 2* is the first to bear the risk of receiving an unknown payment you will read the label [$Risk.Oth_first$]. These labels will be integrated with one of the label for the cost treatment. For instance, if the cost of turning the cards has to be borne by *Participant 2* and *Participant 1* is the first one to bear the risk of the unknown payment, you will find the label [$Cost.Oth/Risk.On_first$].

General Instructions

Welcome,

You are about to take part into an experiment on economic decisions. For being here on time, at the end of the experiment, you will receive 2.50 euros. May you have any doubt during the experiment, please raise your hand and ask a staff member. If you use the computer for activities not strictly related to the experiment, you will be excluded by the experiment and by any payment.

The experiment is divided into two independent parts. In the first part there is only one decisional phase, while in the second part there are two independent decisional phases. Thus, you will face a total of 3 decisional phases.

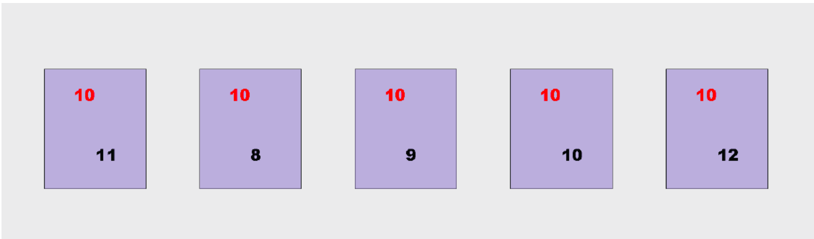
Following you will receive the instructions for the first part of the experiment. Once the first part will end, you will receive the instructions for the second part. We ask you to read the instructions carefully. Before the beginning of each part of the experiment you will have to answer some questions to verify your comprehension of the instructions.

During each phase of the experiment you will have the possibility to earn a sum of euros. This sum will not depend from the sum earned during another phase. Your final payment for the experiment will be defined at the end of the experiment by randomly drawing the earning from one of the three decisional phases.

During the experiment participants will have two roles: *Participant 1* and *Participant 2*. Initially, all the participants will be assigned the role of *Participant 1*, but they will know their actual role only at the end of the experiment. At the end of the experiment half of the participants will be randomly assigned the role of *Participant 1* and the other half the role of *Participant 2*. Every *Participant 1* will be randomly associated to only one *Participant 2*. Choices made by participants who will be assigned the role of *Participant 1* will define earnings for themselves and the *Participant 2* they are associated to, according to the rules that will follow. Thus, choices made by participants who will be assigned the role of *Participant 2* will not be relevant in determining experiment final payments.

Instructions - First Part

In this part of the experiment on your monitor you will be shown 5 cards, each one containing two sums in euros. The red sum in the upper left represents *Participant 1*'s earning, while the black sum in the lower right represents *Participant 2*'s earning. The following figure shows an example of a possible display condition of the cards (the order will be random and it may not correspond to the one in the screenshot below).



During this first phase, *Participant 1*'s earning is always equal to 10 euros. The earning assigned to *Participant 2* can vary depending on *Participant 1*'s choice and can assume an integer value between 8 euros and 12 euros. *Participant 1*'s task is to choose the combination of payments they prefer for themselves and *Participant 2* by clicking the button "I CHOOSE THIS ONE" below the desired card. In order to avoid eventual errors, participants will be asked to confirm their own choices after having made them. In case there would be an error in the choice it will be enough not to confirm it and to repeat the operation.

Instructions - Second Part

The second part of the experiment is composed of two phases. In both phases *Participant 1* will be shown 5 face-down cards (see screenshot below).

Each hole card has on its face two sums corresponding to the earnings for *Participant 1* and *Participant 2*. One of the two participants will always receive a payment equal to 10 euros, while the other participant will receive a payment that may correspond to 8, 9, 10, 11 or 12 euros, depending on the chosen card. In one phase the payment always equal to 10 euros will be given to *Participant 1*, while in the other phase the payment always equal to 10 euros will be given to *Participant 2*. More details about this are provided below.

As in the first phase, the red sum in the upper left represents *Participant 1*'s earning, while the black sum in the lower right represents *Participant 2*'s earning. It is possible to know the couple of earnings associated to each card only by turning the cards. Since the distribution of the cards is randomly determined in every phase, the order of the cards observed in one of the phases does not provide any information about their order in a different phase.

Participant 1 will be asked to make an offer to buy the possibility to turn simultaneously all the 5 cards. The offer will have to be between 0 and 6 euros (included) and it will have to be approximated to the second decimal number, by using a dot to separate integer and decimals.

The probability of turning the cards will depend on the offer made by *Participant 1* and will be defined by following this procedure:

- A value between 0 and 6 will be randomly drawn by the software so that all the values between 0 and 6 have the same probability of being extracted.
- If the randomly drawn value will be less or equal to *Participant 1*'s offer:
  - cards will be turned,
  - [$Cost.Oth$] the value randomly drawn by the software will be deducted from *Participant 2*'s payment indicated on the card chosen by *Participant 1*.
  - [$Cost.Own$] the value randomly drawn by the software will be deducted from *Participant 1*'s payment indicated on the card chosen by *Participant 1*.

- If the randomly drawn value will be higher than *Participant 1*'s offer:
  - cards will not be turned,
  - [*Cost.Oth*] the value randomly drawn by the software will not be deducted from *Participant 2*'s payment indicated on the card chosen by *Participant 1*.
  - [*Cost.Own*] the value randomly drawn by the software will not be deducted from *Participant 1*'s payment indicated on the card chosen by *Participant 1*.

[*Cost.Oth*] Based on this procedure, the best strategy for *Participant 1* is to make an offer corresponding to the maximum value they would like *Participant 2* to pay to turn all the cards.

[*Cost.Own*] Based on this procedure, the best strategy for *Participant 1* is to make an offer corresponding to the maximum value they would like to pay to turn all the cards.

Participant 1's task is to choose the card they prefer. If the combination between offer made and random draw allows to turn the cards, *Participant 1* will have the possibility to choose one of the face-up cards, otherwise they will have to choose one of the cards without knowing the consequences of their choice. In both cases, the choice is made by clicking the button "I CHOOSE THIS ONE" below the desired card.

Participant 1's choice define both *Participant 1* and *Participant 2*'s payments. If the choice is made upon a hole card, *Participant 1* will receive feedback about *Participant 2*'s payment only at the end of the second part.

[*Cost.Oth*] It is important to remember that, if cards are turned, *Participant 2*'s payment will be equal to the payment associated to the chosen card reduced of the value randomly drawn by the software.

[*Cost.Own*] It is important to remember that, if cards are turned, *Participant 1*'s payment will be equal to the payment associated to the chosen card reduced of the value randomly drawn by the software.

During the experiment the term "payment" will correspond to the value illustrated on the cards, while the term "earning" will correspond to the value illustrated on the chosen card reduced by the cost of turning the cards.

The described procedure will be common to the two phases in the second part of the experiment. The two phases will differ only in the distribution of the payments illustrated on the cards.

Phase 1

$[Cost.Oth/Risk.Oth_first]$ *Participant 1*'s payment will be always equal to 10 euros. The payment assigned to *Participant 2* will vary depending on *Participant 1*'s choice and it will have one of the integer values between 8 euros and 12 euros. If cards are turned, the value randomly drawn by software will be deducted from *Participant 2*'s payment.

$[Cost.Own/Risk.Oth_first]$ *Participant 1*'s payment will be always equal to 10 euros. The payment assigned to *Participant 2* will vary depending on *Participant 1*'s choice and it will have one of the integer values between 8 euros and 12 euros. If cards are turned, the value randomly drawn by software will be deducted from *Participant 1*'s payment.

$[Cost.Oth/Risk.Own_first]$ *Participant 2*'s payment will be always equal to 10 euros. The payment assigned to *Participant 1* will vary depending on *Participant 1*'s choice and it will have one of the integer values between 8 euros and 12 euros. If cards are turned, the value randomly drawn by software will be deducted from *Participant 2*'s payment.

$[Cost.Own/Risk.Own_first]$ *Participant 2*'s payment will be always equal to 10 euros. The payment assigned to *Participant 1* will vary depending on *Participant 1*'s choice and it will have one of the integer values between 8 euros and 12 euros. If cards are turned, the value randomly drawn by software will be deducted from *Participant 1*'s payment.

Phase 2

$[Cost.Oth/Risk.Oth_first]$ *Participant 2*'s payment will be always equal to 10 euros. The payment assigned to *Participant 1* will vary depending on *Participant 1*'s choice and it will have one of the integer values between 8 euros and 12 euros. If cards are turned, the value randomly drawn by software will be deducted from *Participant 2*'s payment.

$[Cost.Own/Risk.Oth_first]$ *Participant 2*'s payment will be always equal to 10 euros. The payment assigned to *Participant 1* will vary depending on *Participant 1*'s choice and it will have one of the integer values between 8 euros and 12 euros. If cards are turned, the value randomly drawn by software will be deducted from *Participant 1*'s payment.

$[Cost.Oth/Risk.Own_first]$ *Participant 1*'s payment will be always equal to 10 euros. The payment assigned to *Participant 2* will vary depending on *Participant 1*'s choice and it will have one of the integer values between 8 euros and 12 euros. If cards are turned, the value randomly drawn by software will be deducted from *Participant 2*'s payment.

$[Cost.Own/Risk.Own_first]$ *Participant 1*'s payment will be always equal to 10 euros. The payment assigned to *Participant 2* will vary depending on *Participant 1*'s choice and it will have one of the integer values between 8 euros and 12 euros. If cards are turned, the value randomly drawn by software will be deducted from *Participant 1*'s payment.

Questionnaires

Following we include an English translation of the questionnaires our experimental subjects answered to at the end of the experiment. As explained in the section on the experimental design, our purpose is not to obtain validated psychological measures that can implement our analysis. In fact, we just are interested in gathering some information about possible factors of influence that could drive subjects' decisions during the experiment.

Levenson's Scale

We kindly ask you to answer the following questionnaire truthfully.

We ask you to indicate how much you agree with each of the following statements by using a scale of 6 values that goes from "I don't agree at all" to "I totally agree". Moving your choice on the radio button toward the right you increase your agreement with the statement on the scale that goes from "I don't agree at all" to "I totally agree".

1. To a great extent my life is controlled by accidental happenings.
2. When I make plans, I am almost certain to make them work.
3. Often there is no chance of protecting my personal interests from bad luck happenings.
4. When I get what I want, it's usually because I'm lucky.
5. I have often found that what is going to happen will happen.
6. It's not always wise for me to plan too far ahead because many things turn out to be a matter of good or bad fortune.
7. When I get what I want, it's usually because I worked hard for it.
8. My life is determined by my own actions.

Dospert

We kindly ask you to answer the following questionnaire truthfully.

We kindly ask you to answer the following questionnaire truthfully. For each of the following statements, please indicate the likelihood that you would engage in the described activity or behavior if you were to find yourself in that situation. Provide a rating from Extremely Unlikely to Extremely Likely, using the following scale: 1 = ”Extremely unlikely”, 2 = ”Moderately unlikely”, 3 =”Somewhat unlikely”, 4 = ”Not sure”, 5 =”Somewhat likely”, 6 = ”Moderately likely”, 7 =”Extremely likely”.

1. Admitting that your tastes are different from those of a friend.
2. Betting a day’s income at the horse races.
3. Investing 5% of your annual income in a very speculative stock.
4. Betting a day’s income on the outcome of a sporting event.
5. Investing 10% of your annual income in a new business venture.
6. Choosing a career that you truly enjoy over a more secure one.
7. Speaking your mind about an unpopular issue in a meeting at work.

Demographic and Other Information

Please, fill the following fields.

1. Date of Birth:
2. Gender:
3. Field of Studies:
4. Number of experiment to which you have participated:

3.6 Appendix - Predictions

Decisional Setting

We derive here the predictions about the size of the bid $b \in [0,6]$ that decision makers are paying to turn the cards and solve uncertainty. The individual facing uncertainty chooses over a lottery with five potential outcomes $\pi^1, \ldots, \pi^5$ and each outcome $\pi^i = (\pi^i_x, \pi^i_y)$ gives a payoff of player X and Y. All π^i have the same probability $P(\pi^i) = 1/5$ to be picked when cards are face-down.

A random price $p \sim U(0,6)$ is drawn from a uniform distribution and cards are turned and uncertainty is solved when $b \geq p$. Depending on the treatment, the price p is paid either by the decision maker Y or by the player X and then the decision maker can freely choose the preferred card. When $p < b$, uncertainty is not solved and the decision maker picks one of the cards that are face-down.

Here we derive some behavioral predictions about the size of the bid conditional upon social types and experimental manipulations. We assume that subjects preferences follow the social utility function of Charness and Rabin (hereafter, CR)

$$CR_y(\pi_x, \pi_y) = \begin{cases} (1-\rho)\pi_y + \rho\pi_x & if \quad \pi_y \geq \pi_x \\ (1-\sigma)\pi_y + \sigma\pi_x & if \quad \pi_y < \pi_x \end{cases} \tag{3.2}$$

where CR_y is the utility of a player Y, ρ and σ capture other's welfare concerns, π_x and π_y are respectively player X and player Y's payoffs. Here we focus on two main social types, *Difference-Averse (DA)* and *Welfare Enhancing (WE)*. The latter are characterized by $1 > \rho \geq \sigma > 0$. The former are characterized by $\sigma < 0 < \rho < 1$. For the sake of tractability, we stick to the original model and assume that utility is (piece-wise) linear in monetary payoffs.

Concerning experimental manipulations, decision makers are facing four alternative conditions in which the risk may be borne by themselves or by the other and p may be paid by themselves or by the other.

		Risk	
		Self	Other
Cost	Self	CS/RS	CS/RO
	Other	CS/RO	CO/RO

In the following, we obtain predictions for each of the four alternative conditions.

Cost.Self/Risk.Self (CS/RS)

In this condition, outcomes are $\pi^1 = (8, 10)$, $\pi^2 = (9, 10)$, $\pi^3 = (10, 10)$, $\pi^4 = (11, 10)$, and $\pi^5 = (12, 10)$. Decision makers post a bid b that maximizes their expected utility, as measured by the CR model reported above (equation 3.2). The expected utility of the decision maker is equal to

$$EU[b] = (1 - P_T(b))U_{NT} + \int_0^b \frac{1}{6} CR_y(\pi_x^*(p), \pi_y^*(p) - p)\mathrm{d}p \tag{3.3}$$

where $P_T(b) = \frac{b}{6}$ represents the probability of turning the displayed cards, $U_{NT} = \sum_{i=1}^{5} \frac{1}{5} CR_y(\pi_x^i, \pi_y^i)$ is the (expected) utility when cards are not turned, and $\pi^*(b) = (\pi_x^*(p), \pi_y^*(p))$ is the optimal choice given that cards are turned and price p is paid.

Since $CR_y(\pi_x, \pi_y)$ is increasing in π_y for all feasible ρ and σ, the optimal choice when cards are turned is $\pi^*(p) = \pi^5$ for all p. Then, expected utility becomes:

$$EU[b] = \begin{cases} \left(1 - \frac{b}{6}\right)(50 - 3\rho + 3\sigma) + \int_0^b \frac{1}{6}\left[(1-\rho)(12-p) + \rho 10\right]\mathrm{d}p & if \quad b \leq 2 \\ \left(1 - \frac{b}{6}\right)(50 - 3\rho + 3\sigma) + \int_0^2 \frac{1}{6}\left[(1-\rho)(12-p) + \rho 10\right]\mathrm{d}p + & \\ \qquad + \int_2^b \frac{1}{6}\left[(1-\sigma)(12-p) + \sigma 10\right]\mathrm{d}p & if \quad b > 2 \end{cases} \tag{3.4}$$

Note that: (i) the function is continuous—for $b = 2$ the two equations have the same value—and (ii) both equations are concave parabolae—$(1 - \rho)$ and $(1-\sigma)$ are positive. So in order to find the optimal bid we only need to consider the position of the vertexes of the parabolae that are in $b = \frac{10-7\rho-3\sigma}{5(1-\rho)}$ and $b = \frac{10+3\rho-13\sigma}{5(1-\sigma)}$ respectively. In particular the maximum of the first parabola is in $b \leq 2$ only if $\sigma \geq \rho$ which is never the case, so the function $EU[b]$ is increasing for $b \leq 2$. Moreover the maximum of the second parabola is always in $b \geq 2$ hence the unique optimal bid is $b^* = \frac{10+3\rho-13\sigma}{5(1-\sigma)}$.

The optimal bid goes from $b^* = 2$ when $\sigma = \rho$ to $b^* = 2.6$ when $\sigma \to -\infty$. Moreover, b^* is decreasing is σ and increasing in ρ. This implies that a DA player posts higher bids than a WE player, for a given level of ρ.

Cost.Other/Risk.Self (CO/RS)

In this condition, outcomes are $\pi^1 = (8, 10)$, $\pi^2 = (9, 10)$, $\pi^3 = (10, 10)$, $\pi^4 = (11, 10)$, and $\pi^5 = (12, 10)$. Decision makers post a bid b that maximizes

$$EU[b] = (1 - P_T(b))U_{NT} + \int_0^b \frac{1}{6} CR_y(\pi_x^*(p) - p, \pi_y^*(p))\mathrm{d}p \tag{3.5}$$

Note that, since $CR_y(\pi_x, \pi_y)$ is increasing in π_y for all feasible ρ and σ, also in this case the optimal choice when cards are turned is $\pi^*(p) = \pi^5$ for all p. Thus the expected utility becomes:

$$EU[b] = \left(1 - \frac{b}{6}\right)(50 - 3\rho + 3\sigma) + \int_0^b \frac{1}{6}\left[(1-\rho)12 + \rho(10 - p)\right] \mathrm{d}p \tag{3.6}$$

that is a concave parabola with a global maximum in $b^* = \frac{10-7\rho-3\sigma}{5\rho}$.

The optimal bid goes from $b^* = 0$ when $\rho = \sigma = 1$ to $b^* = 6$ when $\sigma \leq \frac{10-37\rho}{3}$. Moreover, the optimal bid is decreasing both in rho and sigma. This implies that a DA player posts higher bids than a WE player, for a given level of ρ.

Cost.Self/Risk.Oth (CS/RO)

In this condition, outcomes are $\pi^1 = (10, 8)$, $\pi^2 = (10, 9)$, $\pi^3 = (10, 10)$, $\pi^4 = (10, 11)$, and $\pi^5 = (10, 12)$. The expected utility is given by

$$EU[b] = (1 - P_T(b))U_{NT} + \int_0^b \frac{1}{6} CR_y(\pi_x^*(p), \pi_y^*(p) - p)\mathrm{d}p \tag{3.7}$$

Note that if $\sigma \geq 0$ the function $CR_y(\pi_x, \pi_y)$ is increasing in π_x and, hence, the optimal choice when cards are turned is $\pi^*(p) = \pi^5$ for all p. If instead $\sigma < 0$ the function is decreasing in π_x and hence the optimal choice when cards are turned and price p is paid changes with p. In the following we discuss separately the case of $\sigma \geq 0$ and $\sigma < 0$.

For $\sigma \geq 0$ the expected utility is

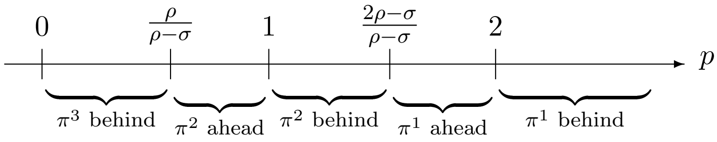
$$EU[b] = \left(1 - \frac{b}{6}\right)(50 - 3\rho + 3\sigma) + \int_0^b \frac{1}{6}\left[(1-\sigma)(10 - p) + \sigma 12\right] \mathrm{d}p \tag{3.8}$$

that is a concave parabola with a global maximum in $b^* = \frac{7\sigma+3\rho}{5(1-\sigma)}$.

For $\sigma < 0$, the optimal choice $\pi^*(p)$ is as follows:

$$\pi^*(p) = \begin{cases} \pi^3 = (10,10) & if \quad p < \frac{\rho}{\rho-\sigma} \\ \pi^2 = (9,10) & if \quad \frac{\rho}{\rho-\sigma} \leq p < \frac{2\rho-\sigma}{\rho-\sigma} \\ \pi^1 = (8,10) & if \quad \frac{2\rho-\sigma}{\rho-\sigma} \leq p \end{cases} \tag{3.9}$$

Hence we need to take into consideration the following intervals when taking the integral over p.



The expected utility becomes

$$EU[b] = \left(1 - \frac{b}{6}\right)(50 - 3\rho + 3\sigma) +$$

$$+ \begin{cases} \int_0^b \frac{1}{6}\left[(1-\sigma)(10-p) + \sigma 10\right] \mathrm{d}p & if \quad b < \frac{\rho}{\rho-\sigma} \\ \int_0^{\frac{\rho}{\rho-\sigma}} \frac{1}{6}\left[(1-\sigma)(10-p) + \sigma 10\right] \mathrm{d}p + \int_{\frac{\rho}{\rho-\sigma}}^b \frac{1}{6}\left[(1-\rho)(10-p) + \rho 9\right] \mathrm{d}p & if \quad \frac{\rho}{\rho-\sigma} \leq b \leq 1 \\ \int_0^{\frac{\rho}{\rho-\sigma}} \frac{1}{6}\left[(1-\sigma)(10-p) + \sigma 10\right] \mathrm{d}p + \ldots + \int_1^b \frac{1}{6}\left[(1-\sigma)(10-p) + \sigma 9\right] \mathrm{d}p & if \quad 1 < b < \frac{2\rho-\sigma}{\rho-\sigma} \\ \int_0^{\frac{\rho}{\rho-\sigma}} \frac{1}{6}\left[(1-\sigma)(10-p) + \sigma 10\right] \mathrm{d}p + \ldots + \int_{\frac{2\rho-\sigma}{\rho-\sigma}}^b \frac{1}{6}\left[(1-\rho)(10-p) + \rho 8\right] \mathrm{d}p & if \quad \frac{2\rho-\sigma}{\rho-\sigma} \leq b \leq 2 \\ \int_0^{\frac{\rho}{\rho-\sigma}} \frac{1}{6}\left[(1-\sigma)(10-p) + \sigma 10\right] \mathrm{d}p + \ldots + \int_2^b \frac{1}{6}\left[(1-\sigma)(10-p) + \sigma 8\right] \mathrm{d}p & if \quad 2 < b \end{cases} \tag{3.10}$$

Note that the function is continuous and each equation is a concave parabola.[11]

The maxima of the parabolae in b are equal to $\frac{3\rho-3\sigma}{5(1-\sigma)}$, $\frac{-2\rho-3\sigma}{5(1-\rho)}$, $\frac{3\rho-8\sigma}{5(1-\sigma)}$, $\frac{-7\rho-3\sigma}{5(1-\rho)}$, and $\frac{3\rho-13\sigma}{5(1-\sigma)}$, respectively.

Suppose that the maximum of the parabola defined in equation i is in the interval where equation i defines EU. Obviously, this point is also a local maximum of the EU over that interval. Moreover, it easy to check that equations $j < i$, i.e., the parabolae to the left of i, have their maximum to the right of their intervals; while equations $j > i$, i.e., parabolae to the right of i, have their maximum to the left of their intervals. This implies that EU is increasing over the domain of equations $j < i$ and decreasing over the domain of equations $j > i$ so the local maximum is the unique global maximum of EU.

[11]In each equation, b is present only in the common part $\left(1 - \frac{b}{6}\right)(50 - 3\rho + 3\sigma)$ and in the last integral.

Given this, the optimal bid for $\sigma < 0$ is the following:

$$b^* = \begin{cases} \frac{3\rho-3\sigma}{5(1-\sigma)} & if \quad \frac{\rho-\sqrt{60\rho-35\rho^2}}{6} < \sigma < 0 \\ \frac{-2\rho-3\sigma}{5(1-\rho)} & if \quad \rho-\frac{5}{3} \leq \sigma \leq \frac{\rho-\sqrt{60\rho-35\rho^2}}{6} \\ \frac{3\rho-8\sigma}{5(1-\sigma)} & if \quad \frac{-5+\rho-\sqrt{25+110\rho-35\rho^2}}{6} < \sigma < \rho-\frac{5}{3} \\ \frac{-7\rho-3\sigma}{5(1-\rho)} & if \quad \rho-\frac{10}{3} \leq \sigma \leq \frac{-5+\rho-\sqrt{25+110\rho-35\rho^2}}{6} \\ \frac{3\rho-13\sigma}{5(1-\sigma)} & if \quad \sigma < \rho-\frac{10}{3} \end{cases} \tag{3.11}$$

Note that the optimal bid for $\sigma < 0$ is a continuous function and it is a continuous function also considering the optimal bids when $\sigma \geq 0$.[12] The optimal bid goes from $b^* = 0$ when $\rho = \sigma = 0$ to $b^* = 6$ when $\rho > 0.75$ and $\sigma \geq \frac{30-\rho}{37}$.

The behavior of the optimal bid with respect to ρ is not univocal. Indeed, while the bid is increasing in ρ on the "odd" intervals, on the "even" intervals its behavior depends on the value of sigma. The behavior of the optimal bid with respect to sigma is smoother: b^* is decreasing in σ on all the intervals for $\sigma < 0$, while it is increasing in σ for $\sigma > 0$. When comparing DA and WE, the ordering of b^* for the two types strictly depends on the level of σ, for a given ρ. Thus, no sharp predictions can be drawn in this condition for distinct types.

Cost.Oth/Risk.Oth (CO/RO)

In this condition, outcomes are $\pi^1 = (10, 8)$, $\pi^2 = (10, 9)$, $\pi^3 = (10, 10)$, $\pi^4 = (10, 11)$, and $\pi^5 = (10, 12)$. Decision makers post a bid b that maximizes

$$EU[b] = (1 - P_T(b))U_{NT} + \int_0^b \frac{1}{6} CR_y(\pi_x^*(p), \pi_y^*(p) - p)\mathrm{d}p \tag{3.12}$$

As before, since the CR function is increasing in π_x only if $\sigma \geq 0$, the optimal choice $\pi^*(p)$ is π^5 for $\sigma \geq 0$ and it changes with p for $\sigma < 0$.

In the first case, i.e., for $\sigma \geq 0$, the expected utility is

$$EU[b] = \begin{cases} \left(1-\frac{b}{6}\right)(50-3\rho+3\sigma) + \int_0^b \frac{1}{6}\left[(1-\sigma)10+\sigma(12-p)\right]\mathrm{d}p & if \quad b < 2 \\ \left(1-\frac{b}{6}\right)(50-3\rho+3\sigma) + \int_0^2 \frac{1}{6}\left[(1-\sigma)(10)+\sigma(12-p)\right]\mathrm{d}p + \\ \quad + \int_2^b \frac{1}{6}\left[(1-\rho)10+\rho(12-p)\right]\mathrm{d}p & if \quad b \geq 2 \end{cases} \tag{3.13}$$

Note that the function is continuous and the two equations are a concave parabolae with maxima in $b = \frac{7\sigma+3\rho}{5\sigma}$ and $b = \frac{-3\sigma+13\rho}{5\rho}$ respectively. Note also

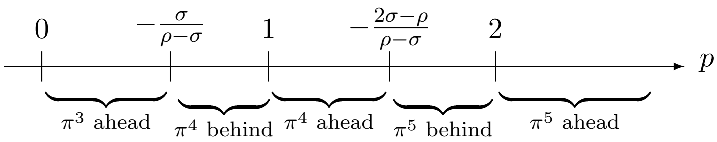
[12] It is easy to check that, at the interval boundaries, b^* has the same value when approaching from the left and from the right.

that the maximum of the first parabola is in $b < 2$ only if $\sigma > \rho$ which is never the case. So expected utility is increasing in b for $b < 2$. Moreover, the maximum of the second parabola is always in $b \geq 2$ (recall $\sigma \leq \rho$) and hence there is a unique global maximum in $b^* = \frac{-3\sigma+13\rho}{5\rho}$.

In the second case, i.e., for $\sigma < 0$, the optimal choice $\pi^*(p)$ is as follows:

$$\pi^*(p) = \begin{cases} \pi^3 = (10,10) & if \quad p \leq -\frac{\sigma}{\rho-\sigma} \\ \pi^4 = (11,10) & if \quad -\frac{\sigma}{\rho-\sigma} < p \leq -\frac{2\sigma-\rho}{\rho-\sigma} \\ \pi^5 = (12,10) & if \quad -\frac{2\sigma-\rho}{\rho-\sigma} < p \end{cases} \tag{3.14}$$

Hence we need to take into consideration the following intervals when taking the integral over p.



The expected utility becomes

$$EU[b] = \left(1 - \frac{b}{6}\right)(50 - 3\rho + 3\sigma) +$$
$$+ \begin{cases} \int_0^b \frac{1}{6}\left[(1-\rho)10 + \rho(10-p)\right] \mathrm{d}p & if \quad b \leq -\frac{\sigma}{\rho-\sigma} \\ \int_0^{-\frac{\sigma}{\rho-\sigma}} \frac{1}{6}\left[(1-\rho)10 + \rho(10-p)\right] \mathrm{d}p + \int_{-\frac{\sigma}{\rho-\sigma}}^b \frac{1}{6}\left[(1-\sigma)10 + \sigma(11-p)\right] \mathrm{d}p & if \quad \frac{\rho}{\rho-\sigma} < b < 1 \\ \int_0^{-\frac{\sigma}{\rho-\sigma}} \frac{1}{6}\left[(1-\rho)10 + \rho(10-p)\right] \mathrm{d}p + \ldots + \int_1^b \frac{1}{6}\left[(1-\rho)10 + \rho(11-p)\right] \mathrm{d}p & if \quad 1 \leq b \leq -\frac{2\sigma-\rho}{\rho-\sigma} \\ \int_0^{-\frac{\sigma}{\rho-\sigma}} \frac{1}{6}\left[(1-\rho)10 + \rho(10-p)\right] \mathrm{d}p + \ldots + \int_{-\frac{2\sigma-\rho}{\rho-\sigma}}^b \frac{1}{6}\left[(1-\sigma)10 + \sigma(12-p)\right] \mathrm{d}p & if \quad -\frac{2\sigma-\rho}{\rho-\sigma} < b < 2 \\ \int_0^{-\frac{\sigma}{\rho-\sigma}} \frac{1}{6}\left[(1-\rho)10 + \rho(10-p)\right] \mathrm{d}p + \ldots + \int_2^b \frac{1}{6}\left[(1-\rho)10 + \rho(12-p)\right] \mathrm{d}p & if \quad 2 \leq b \end{cases} \tag{3.15}$$

Note that, also in this case the function is continuous and each equation is a parabola. However, while the equations in the odd cases are concave parabolae, the equations in the even cases are convex parabolae.[13] This implies that there cannot be a maximum for b in the intervals $\left(-\frac{\sigma}{\rho-\sigma}, 1\right)$ and $\left(-\frac{2\sigma-\rho}{\rho-\sigma}, 2\right)$. The vertexes of the parabolae are, respectively in $\frac{3\rho-3\sigma}{5\rho}$, $\frac{3\rho+2\sigma}{5\sigma}$, $\frac{8\rho-3\sigma}{5\rho}$, $\frac{3\rho+7\sigma}{5\sigma}$, and $\frac{13\rho-3\sigma}{5\rho}$.

Moreover, note that for the feasible values of ρ and σ: (i) the vertex of the second parabola, which is in $\frac{3\rho+2\sigma}{5\sigma}$, is always to the left of $-\frac{\sigma}{\rho-\sigma}$; (ii) the vertex of the fourth parabola, which is in $\frac{3\rho+7\sigma}{5\sigma}$, is always to the left of $-\frac{2\sigma-\rho}{\rho-\sigma}$; (iii) the vertex of the first parabola, which is in $\frac{3\rho-3\sigma}{5\rho}$, is always to the right of $-\frac{\sigma}{\rho-\sigma}$; (iv) the vertex of the third parabola, which is in $\frac{8\rho-3\sigma}{5\rho}$, is always to the right of $-\frac{2\sigma-\rho}{\rho-\sigma}$. This implies that the EU function is increasing for b in the

[13] This because in equation 2 and 4 the coefficient of b^2 is $-\frac{\sigma}{12}$ which is positive.

interval $[0,2)$. Finally, the vertex of the fifth parabola—which is concave—is in $b = \frac{13\rho-3\sigma}{5\rho}$ that is bigger than 2 if $\rho > \sigma$ that is always the case. Hence, the unique global maximum is for $b^* = \frac{13\rho-3\sigma}{5\rho}$ that is the same optimal bid obtained for $\sigma \geq 0$.

The optimal bid goes from $b^* = 2$ when $\rho = \sigma$ to $b^* = 6$ when $\sigma \leq \frac{-17\rho}{3}$. Moreover, the optimal bid is decreasing in sigma while it is increasing in rho for $\sigma > 0$ and decreasing in rho for $\sigma < 0$. Thus, similar to what happens in CO/RS, a DA player posts higher bids than a WE player, for a given ρ.

Comparison of optimal bids across treatments

Here we compare optimal bids across conditions. Figure 3.6.1 shows an example of the optimal bids as a function of σ in the four treatments. In the figure it is assumed that the agent has a $\rho = 0.3$. The continuous lines identify conditions in which risk is borne by the decision maker $(\cdot/RS)$ and the dashed lines conditions in which risk is borne by the other $(\cdot/RO)$; the blue lines identify conditions in which the cost is borne by the decision maker $(CS/\cdot)$ and the red lines conditions in which the cost is borne by the other $(CO/\cdot)$.

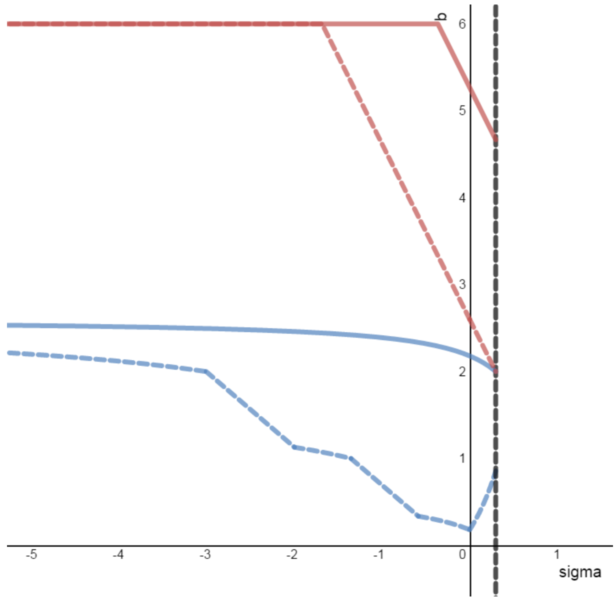
We start by comparing the bids b^* when risk is shifted from the decision maker to the other agent. Thus, we compare i) $b^*_{CS/RS}$ and $b^*_{CS/RO}$ and ii) $b^*_{CO/RS}$ and $b^*_{CO/RO}$. We obtain that

- for $CO/\cdot$, we have that b^* when the risk is borne by the decision maker is bigger than b^* when the risk borne by the other when $\frac{10-7\rho-3\sigma}{5\rho} \geq \frac{13\rho-3\sigma}{5\rho}$, i.e., when $\rho \leq 0.5$.

- for $CS/\cdot$, we need to compare b^* when the risk is borne by the decision maker, i.e., $\frac{10+3\rho-13\sigma}{5(1-\sigma)}$ with all the cases of b^* when the risk is borne by the other.

  We start with $\sigma < 0$. In this case it is easy to check that, on the odd intervals, $\frac{10+3\rho-13\sigma}{5(1-\sigma)}$ is always bigger than b^* when the risk is borne by the other. Consider now the interval $\left[\rho - \frac{5}{3}, \frac{\rho-\sqrt{60\rho-35\rho^2}}{6}\right]$, and assume $\frac{10+3\rho-13\sigma}{5(1-\sigma)} < \frac{-2\rho-3\sigma}{5(1-\rho)}$. This implies that $\sigma < \frac{11\rho-10-\sqrt{85\rho^2-280\rho+220}}{6}$. However, this quantity is smaller than $\rho - \frac{5}{3}$; so the optimal bid when

FIGURE 3.6.1: Optimal bids $b^*(\rho = .3)$



The blue solid line represents the optimal bid for CS/RS; the blue dashed line represents the optimal bid for CS/RO; the red solid line represents the optimal bid for CO/RS; the red dashed line represents the optimal bid for CO/RO.

the risk is borne by the decision maker is bigger than the optimal bid when risk is borne by the other player also on the second interval. Consider the fourth interval, i.e., $\left[\rho - \frac{10}{3}, \frac{-5+\rho-\sqrt{25+110\rho-35\rho^2}}{6}\right]$, and suppose $\frac{10+3\rho-13\sigma}{5(1-\sigma)} < \frac{-7\rho-3\sigma}{5(1-\rho)}$. This implies that $\sigma < \frac{6\rho-10-\sqrt{220-120\rho}}{6}$ but this contradicts $\sigma \geq \rho - \frac{10}{3}$ and, hence, also on the fourth interval the optimal bid when the risk is borne by the decision maker is bigger than the optimal bid when risk is borne by the other player.

For $\sigma \geq 0$ we have that $\frac{10+3\rho-13\sigma}{5(1-\sigma)} \geq \frac{7\sigma+3\rho}{5(1-\sigma)}$ is satisfied when $\sigma \leq 0.5$. Given that $\sigma \leq \rho$ by assumption, $\rho \leq 0.5$ is a sufficient condition to ensure that the optimal bid when the risk is borne by the decision maker is bigger than the optimal bid when the risk is borne by the other player.

To summarize, any decision maker, irrespective of her social preferences, is going to bid higher when risk is borne by her than when risk is borne by the other, keeping fixed the subject paying to turn the cards. If we (reasonably) assume $\rho \leq 0.5$, we can completely rank the bids in the four experimental conditions by knowing that the optimal bid in CS/RS is always smaller than the optimal bid in CO/RO, i.e. $\frac{13\rho-3\sigma}{5\rho} \geq \frac{10+3\rho-13\sigma}{5(1-\sigma)}$ when $\sigma \leq \rho$ and $\rho \leq 0.5$.

Then, for a given level of ρ, we predict the following rank in optimal bids: $b^*_{CO/RS} \geq b^*_{CO/RO} \geq b^*_{CS/RS} \geq b^*_{CS/RO}$. Moreover, in CO/RS and CO/RO we should observe $b^* \geq 2$, while in CS/RS and CS/RO we should observe $b^* \leq 2.6$. As shown also by Figure 3.6.1, this implies that the difference between optimal bids is more pronounced when shifting the cost from the decision maker to the other than when shifting the risk.

Chapter 4

Tell Me How to Rule: Leadership, Delegation and Voice in Cooperation

with Marco Faillo and Luigi Mittone

4.1 Introduction

Cooperation in finitely repeated Public Good experiments has been widely tested during the past, producing results that, in general, have generated discrepancies from standard economic theories. According to these, subjects should never contribute to the Public Good, as this strategy does not represent an equilibrium. Experimental evidence (Fehr and Gächter, 2000; Chaudhuri, 2011) shows that the general tendency in Public Good games is for subjects to start contributing an amount within the 40 and 60% of their endowments and, as the game proceeds, to decrease contribution. One of the causes of such a decay is often attributed to the *end-game effect*: when approaching the end of a finite game, subjects tend to reason using backward induction and to free ride. Yet, an alternative theory is that subjects, during the game, go through a learning process and adapt their behavior, changing strategy (Isaac and Walker, 1988). Such a decay in contribution is not observed when punishment is implemented (Fehr and Gächter, 2000).

More recently, studies involving public good experiments have driven the attention to leadership and its effects on cooperation tasks. Güth et al. (2007) proved that leadership affects intra-group cooperation. The authors implemented a leadership by example mechanism, where leaders are first movers and followers can imitate their choices: results show that the presence of a first mover-leader cause a substantial improve in cooperation.

A more recent study by Fleiß and Palan (2013) compares voluntary contributions and leader-allocated contributions in public goods. Results show that public-good games with allocators achieve higher levels of cooperation and contribution. Furthermore, the authors prove that the majority of the subjects taking part to their experiment is willing to delegate decisions to a leader in order to exploit benefits of cooperation. Such being the case, leaders could take advantage of their position to reap the benefits of cooperation, choosing higher contributions for their follower and deciding to free ride. In spite of this, the presence of a leader is usually beneficial for the economy of a group.

Hamman, Weber, and Woon (2011), similarly, explain how centralized decision-making is more efficient for the provision of a public-good. The authors find among subjects a general necessity for actions coordination while pursuing a common goal, especially in settings with large groups. Furthermore, the authors find that communication fosters coordination, by reducing the problem of free-riding.

General evidence supports the hypothesis that leadership improves cooperation in social dilemmas; nevertheless, we are not aware of the effects that leadership can have on cooperation game where leaders interact with each others. In our experimental study, leaders represent their own groups interacting into a public good game, but every choice they make directly falls back on their followers, that have no decisional power. This experimental setting differs from the ones used so far in this field, as we combine two different dimensions: leadership in coordination games, and delegated decision-making.

At the best of our knowledge, our experiment is the first aimed to investigate how delegated leaders, whose incentives are aligned to their followers', interact into a Public Good experiment. Most of the existing experiments are aimed to test how leadership affect intra-group cooperation, meaning that leaders are asked to interact only with their followers, leaving aside cooperation between leaders.

In particular, we focus on the implementation of leadership with dictating power, leaving aside the aspects of leadership by example (Güth et al., 2007; Levati, Sutter, and Heijden, 2007). Our study is mainly aimed to understand whether leadership can help improve cooperation when individuals have to play a public good game, and they know that their actions directly affect others: in this sense, leaders are responsible for their own group and are asked to make delegated choices. As explained by Humphrey and Renner (2011), when delegated agents have to interact with other individuals, the sense of responsibility affects their choices, as they perceive their power to determine others' payoffs.

Similarly to what done in other experiments on cooperation in public goods experiments, we included the possibility for subjects to implement punishment (Fehr and Gächter, 2002; Egas and Riedl, 2005). Previous studies proved that, depending on the cost, subjects punish more or less frequently, and that, in general, punishment has a positive effect on cooperation: it is usually able to increase contributions and to reduce free riding.

Hamman, Weber, and Woon (2011) found that subjects taking part in a public good experiment show willingness to delegate their decisions only when communication is allowed. Xiao and Houser (2009) and Ellingsen and Johannesson (2008) provide evidence of the importance of one-sided communication in dictator games: when recipients have *voice*, this works as a psychological device that reduces dictators' aggressiveness. Additional contributions to this literature are provided by Capizzani et al. (2015) and Mittone and Musau (2016), who find similar results testing communication in social dilemmas. Following these findings, we decided to test the effect of communication in our experimental setting, by adding an additional treatment where one-sided communication is allowed at the end of each round.

Decisions made by subjects taking part to the treatments with simple leadership and leadership with communication were compared to the ones obtained in the public good game with punishment. The setting we implemented is similar to the one used by Fehr and Gächter (2000), that only differs in the number of rounds.

Our findings demonstrate that contribution to the public good is, on average, higher in the treatment with leadership. The same can be said about the use of punishment, which is implemented more frequently when leaders can decide and communication is not allowed. The higher frequency of punishment, though, jeopardizes the positive effects on efficiency derived from leadership, so that results in terms of final payoff are better in groups with no leaders (i.e.

our baseline), and in groups with leadership and communication.

We can say that, in our experimental setting, leadership has, overall, a positive effect on contribution and cooperation. Nevertheless, communication is a needed in order to push leaders to make choices that are actually beneficial to their group. In addition to this, we find that implementing leadership with communication it is possible to obtain average final payoffs that do not significantly differ from the one obtained by subjects deciding individually.

4.2 Methodology

4.2.1 Task

The experiment is based on a repeated Public Good game with free contribution and punishment opportunities (Fehr and Gächter, 2000), and consists of three different treatments, applied in a between subjects fashion. In all the treatments participants are divided into groups of 4 members each, and every group plays a separate Public Good game over 20 rounds. Each round consists of two phases. During the first (contribution) phase, subjects receive an endowment E of 20 tokens, and have to choose how many of these they want to allocate to the Public Good. Every token invested in the Public Good is multiplied by 1.6 and then equally divided among the four members of the group. At the end of this first phase, subjects are informed about their payoffs. This is the sum of the tokens not allocated to the Public Good and a share equal to the 40% of the total sum invested by the group: Thus, subject i's payoff for the first phase is determined as follows:

$$\pi_{i,1} = (E - c_i) + \alpha * \sum_{i=1}^{4} c_i,$$

where c_i is subject i's contribution to the Public Good, and α is the Public Good multiplication factor equal to 0.4. Subjects' payoffs are all determined in the same way and every member of a group receives the same share of the Public Good.

After receiving information about their payoff, subjects enter the second phase of the round and receive details about other members' contributions.

At this point, each group member can decide whether to reduce or leave unchanged the payoffs obtained by every other member during the first phase of the round. To do this, each subject can assign to his peers up to 10 points: every point that participants receive reduces by 10% the payoff accumulated in the first phase. Specifically, subjects can decide how many points they want to assign to each one of their group members. If subjects do not want to reduce others' payoff they have to assign 0 points. Else, they can decide by what percentage to reduce others' payoff and choose the corresponding number of points. To assign points is costly and the price varies depending on the number of points one wants to distribute. Within the experiment instructions, subjects are provided with a table that summarizes the cost of points.

Table 4.1: Points Cost

POINTS	0	1	2	3	4	5	6	7	8	9	10
COST	0	1	2	4	6	9	12	16	20	25	30

At the end of the second phase, subject i's payoff function is as follows:

$$\pi_{i,2} = \pi_{i,1} - \sum_{j \neq i} cost_{ij,2} - 0.10 * \pi_{i,1}(\sum_{j \neq i} p_{ji,2}),$$

where $\pi_{i,1}$ is subject i's payoff at the end of the first phase, $cost_{ij,2}$ is the cost for the points assigned by subject i and $p_{ji,2}$ are the points assigned to player i, both during the second phase.

By assigning 10 points to subjects, it is possible to reduce their first phase payoff by 100%. Following the experimental structure by Fehr and Gächter (2000), in order to prevent negative payoffs, even if subjects can receive more than 10 points, their payoff cannot be reduced by more than 100%. After having chosen how many points to assign, subjects receive feedback about this second phase and proceed to the following round. This procedure is repeated for 20 rounds, then subjects are informed about their final payment, that is equal to the sum of the payments obtained in the 20 rounds.

4.2.2 Treatments

The experiment consists of three different treatments: one serves as a baseline and is a replication of Fehr and Gächter (2000), while the other two include manipulations.

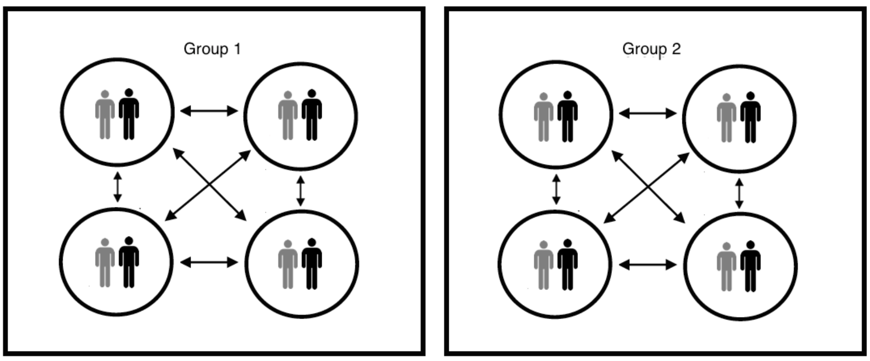
We use the *baseline* to gather data about individuals average contributions within the Public Good game described in the previous section. Average contributions are used to drive a comparison with the ones obtained in the two manipulation treatments.

The two manipulation treatments allow us to test two different factors: the first is how the awareness of being responsible for others affect individual decision making (treatment *couple*); and the second add to responsibility for others, also an higher social pressure as cheap-talk is allowed (treatment *chat*).

In the treatment *couple* subjects are matched in four couples; thus, every group is composed by eight members: four *drawn participants* and the four participants they are paired with (henceforth *followers*); the composition of couples and groups remain the same during the whole experiment.

Figure 4.1 represents a standard experimental session with 16 participants: these are divided into two groups of four couples, each consisting of a *leader* and a *follower*, represented by the black and the gray silhouette respectively. The arrows explain how *leaders* of couples belonging to the same group interact among each other, playing the Public Good game.

FIGURE 4.1: Group Structure - *Couple*



Each one of the 2 groups plays the 20 round Public Good game with punishment described in the previous section. Depending on the role participants are assigned to, they are asked to perform a different task: in the first phase of every round, *drawn participants* have to choose how much to contribute to the *common project*, and in the second phase they can decide how many punishment points to assign to other group members; *followers* can only observe what *drawn participants* do, but they are asked to express their hypothetical choices as if they were *drawn participants*. This helps to keep them busy and to keep private the identity of the *drawn participants* within the laboratory. As *drawn participants* decide for themselves and the participants they are paired with, in the first phase their are given an endowment of 40 tokens (i.e. double with respect to the one provided in the *baseline*). Tokens invested in the *common project* are multiplied by 1.6 and equally divided among the 4 group members. Since in this treatment group members are, in fact, couples, participants receive half of the payoff addressed to their couple, which is entirely determined by the decisions made by the *drawn participants*. Once every *drawn participant* has chosen how much to contribute, the first phase ends. At the beginning of the second phase participants are informed about their group contribution and *drawn participants* can decide to assign some points to other group members. Similarly to what happens in the first phase, the costs of the points is doubled (Table 4.2). *Drawn participants* are entitled to decide how many points they want to assign, but the cost of this action is to be equally divided among the members of the couple.

Table 4.2: Points Cost - *Couple* Treatment

POINTS	0	1	2	3	4	5	6	7	8	9	10
COST	0	2	4	8	12	18	24	32	40	50	60

Note that if a couple receives points both members are affected and their payoffs decrease. After that all the *drawn participants* have decided how many points to assign, all the participants receive updated feedback about their payoff for the round and proceed. This procedure is repeated for 20 rounds, then subjects are informed about their final payment and the experiment is over.

The *chat* treatment is characterized by the same experimental setting utilized for the *couple* treatment, with the addition of one feature: followers are still asked to express their hypothetical decisions, but they can also send brief communications the *drawn participants* their are paired with. Communication of personal information, PC number, threats, promises of side payments and the use of offensive language were prohibited.

4.2.3 Participants and Procedures

The experiment was conducted in the Cognitive and Experimental Economics Laboratory (CEEL) of the University of Trento. The experiment was designed and administrated by using Borland Delphi.[1] Participants recruited were, on average, 23 years old second year students, 55% of them from the faculty of economics, and 45% are females. On average, participants had taken part to 5 experiments before. The total number of subjects is 360, and they were divided across treatments as shown in Table 4.3.

Table 4.3: Number of Participants

Treatment	Sessions (Num.)	Participants (Num.)	Observations (Num.)
baseline	4	72	18
couple	10	160	20
chat	8	128	16
Total	22	360	54

Each subject received a 3.00 euros show-up fee, plus a sum that varied depending on their performance in the experiment; this was, on average, equal to 8 euros. Upon their arrival, subjects were randomly assigned to a computer and received instructions for the experiment, which also contain few comprehension questions; subjects had 7 minutes to read the instructions and try to answer. Then, instructions were read aloud and the correct answer were provided by one of the experimenters, who also answered any possible question.

4.2.4 Behavioral Predictions

With regard to the *c*ouple and the *c*hat treatment, Charness and Jackson (2009) report experimental evidence of the effects that being responsible for someone's payoff has on subjects. Specifically, the authors tested dictators' leadership in a coordination game, finding that the majority of subjects showed a greater risk aversion when responsible for others. This study have extended the *responsibility-alleviation effect* (Charness, 2000) to the dimension of coordination games, showing how the presence of a unique decision maker in a

[1] We express our sincere appreciation for Marco Tecilla's support.

two-persons group can work as an instrument to increase coordination and welfare.

Additional evidence about leadership and cooperation in public good games can be found is some recent experiments (among the others Fleiß and Palan, 2013; Bolle and Vogel, 2011). These, although have diverse experimental settings and manipulations, are characterized by a common finding: leadership improves cooperation.

With respect to the aspects described, and accordingly to our premises, we formulate the following behavioral predictions:

Hypothesis 4.1 *Contributions:*
In all the three treatments participants will contribute to the Public Good.

Hypothesis 4.2 *Social Welfare:*
When representing a couple, subjects will invest more in the Public Good.

Hypothesis 4.3 *Punishment:*
Subjects will punish free-riders and low contributors; responsibility for others increases the use of punishment.

Hypothesis 4.4 *Communication:*
In the treatment chat followers will communicate with leaders affecting their decisions.

4.3 Results

This section includes an analysis divided into three main focus areas: contributions, payoff and punishment. Note that, with regard to the treatments *couple* and *chat*, we only use decisions made by individuals assigned the role of *drawn participants*; in fact, as explained in the Methodology section, *followers* were asked to express their decisions with the only aim of keeping them busy during the experiment and preserving roles anonymity. In addition to this, we include a section specifically addressed to the analysis of communication in treatment *chat*.

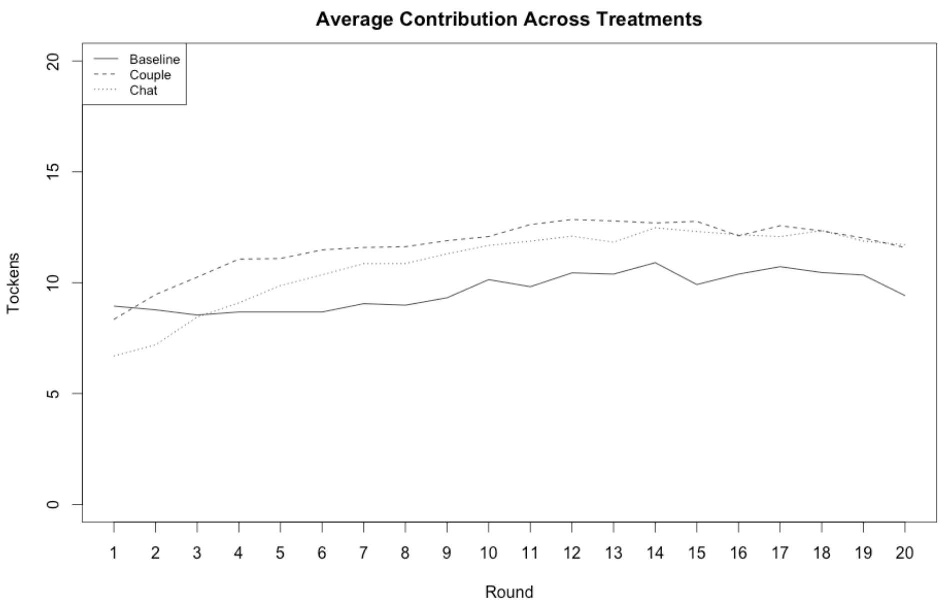
4.3.1 Contributions

Figure 4.1 shows the average percentage contribution to the Public Good per round across the three treatments.

We observe both *couple* and *chat* treatments are characterized by higher average contributions with respect to the *baseline*.

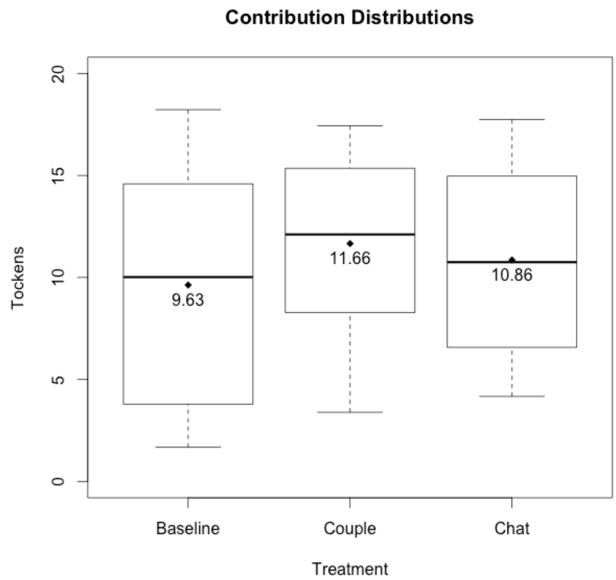
Result 4.1 *In all the three treatments subjects contribute to the Public Good investing positive sums.*

Figure 4.1: Average Percentage Contribution per Round



The boxplot in Figure 4.2 provides more precise information about the difference in the average percentage contributions across treatments.

FIGURE 4.2: Average Percentage Contribution per Treatment



The three distributions seem to confirm the presence of a difference in terms of contributions between the *baseline* and the other treatments. In the *baseline* subjects have contributed on average with 48% of their endowment, while in the *couple* and *chat* treatments average individual contributions are, respectively, equal to 58% and 54% (black dots and numbers). Non-parametric tests show a significant difference in contributions between the *baseline* and *couple* treatments.[2]

Result 4.2 *In all the three treatments contributions to the Public Good will be, on average, positive.*

Result 4.3 *When deciding for others (and no communication is allowed), subjects tend to invest more in the Public Good trying to increase their group welfare.*

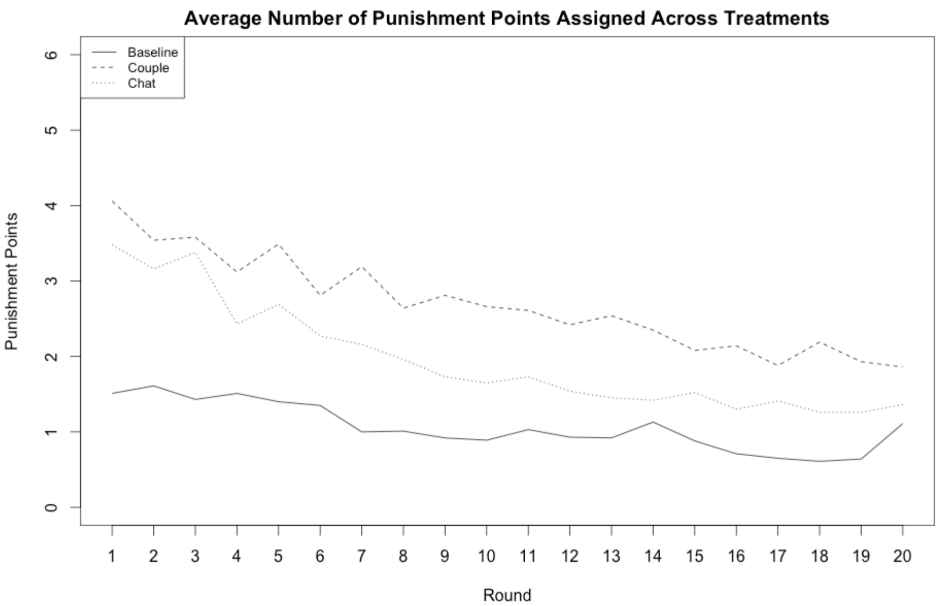
[2]One-tailed tests on groups' average values across rounds: Wilcoxon-Mann-Whitney, p-value = 0.0834; Fligner-Policello, p-value = 0.0778.

The difference between *baseline* and *chat* is not significant according to non-parametric tests.[3]

4.3.2 Punishment

As for the level of punishment (figure 4.3), we find strictly positive values in every treatment.

FIGURE 4.3: Average Points of Punishment per Round



In general, punishment seems to be implemented more frequently in treatments with delegation, that do no significantly differ from each other[4]; this suggests that subjects punish more when responsible for others.

As already pointed out in previous studies (Herrmann, Thöni, and Gächter, 2008), it is possible to make a distinction between two different types of punishment: the *altruistic punishment* that aims to punish free-riders and low

[3]Nevertheless, figure 4.1 suggests that the first five rounds could be considered a transition phase: *couple* contributions start around the 42%, while *chat* contributions start at 33% and both quickly grow by 10 and 15 percentage points. Thus, we tried to repeat our tests excluding data from these rounds. Results confirm our hypothesis; in fact, we find stronger evidence of the difference between *baseline* and *couple* (One-tailed tests: Wilcoxon-Mann-Whitney, p-value = 0.0739; Fligner-Policello, p-value = 0.0697), but results are still negative for as concerns the *chat* treatment.

[4]Two-sidedWilcoxon-Mann-Whitney on group average across rounds: *couple* vs *baseline* p-value = 0.0006; *chat* vs *baseline* p-value = 0.007; *couple* vs *chat* p-value = 0.13

cooperators, and the so called *antisocial punishment* directed to cooperators.[5] We found evidence of the implementation of both these forms of punishment.

Table 4.1: Average Points of Punishment Assigned

Treatment	Points Assigned	Antisocial (%)
baseline	1,06	21,2%
couple	2,69	18,2%
chat	1,76	14,5%

Points Assigned: average number of punishment points assigned; *Antisocial (%)*: percentage of antisocial punishment over the points assigned.

Values in table 4.1 represent the average number of points of punishment assigned across treatments. In general, it is possible to observe how treatments *couple* and *chat* are characterized by a greater use of punishment. As it was already pointed out by the results of the non-parametric test, leaders punished more than subjects in the *baseline*.

Result 4.4 *Subjects punish free-riders and low contributors. Leadership increases the use of punishment.*

For as concerns antisocial punishment, our results are in line with previous studies, but we observe a difference across the three treatments. Running a non-parametric test we find that antisocial punishment in the treatment chat is lower than in the *baseline*; furthermore, we observe that in the treatment *couple* antisocial punishment is higher than in the *chat* one.[6]

4.3.3 Payoff

Our results suggest, so far, that decision makers in charge as leaders tend to contribute more to the common project and also to punish more. Nevertheless, we also find that these effects are weakened in the *chat* treatment. Thus, in order to have a more clear understanding of subjects' welfare, it is more appropriate to focus on payoffs.

[5] Our experimental design is not aimed to investigate and provide an explanation to this particular phenomenon; thus, we leave a deeper analysis to further studies.

[6] Two-sided Wilcoxon-Mann-Whitney on groups' average: *chat* vs *baseline* p-value = 0.09; *chat* vs *couple* p-value = 0.05.

Figure 4.4: Average Payoff per Round

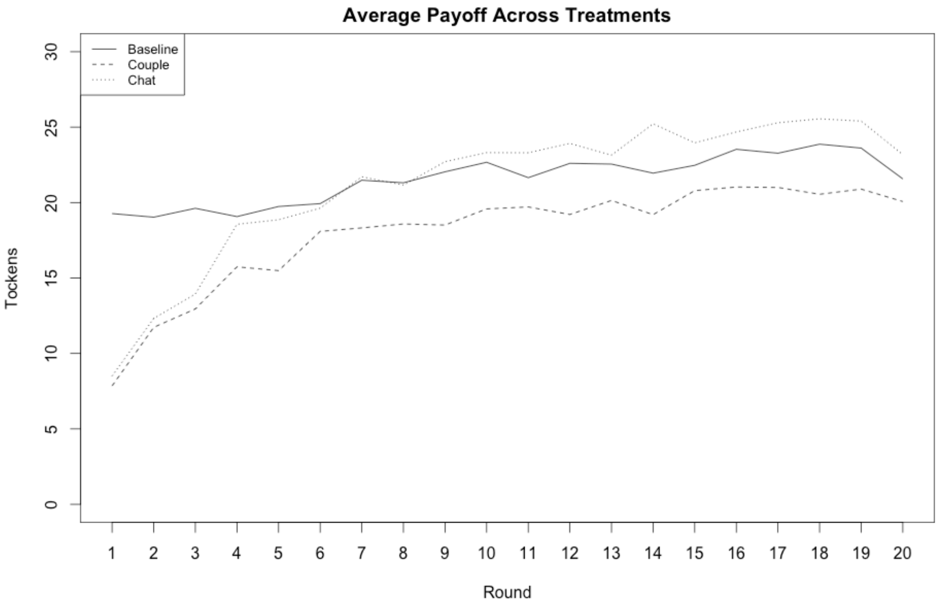
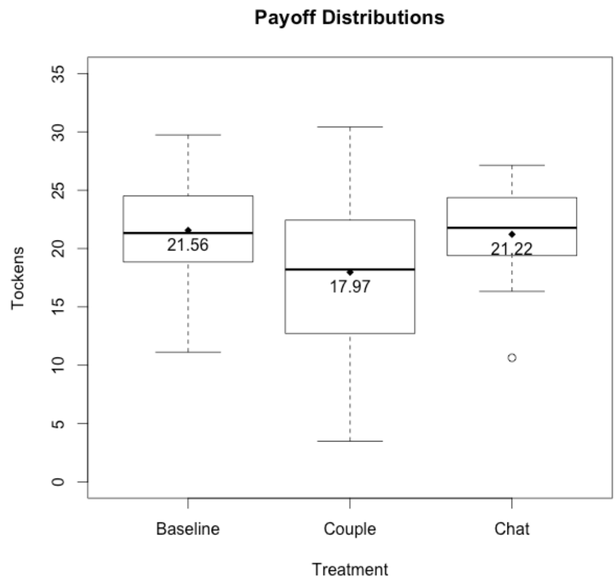


Figure 4.4 reports the average payoff at the end of every round; this means that payoffs are taken after that punishment has occurred. Contrarily to what found concerning contributions, here we observe that payoffs in the treatment *chat* are higher than in the treatment *couple*. This suggests that, in spite of the lower level of contributions, subjects decided to punish less in order to preserve general welfare. Furthermore, payoffs in the *baseline* follow a flatter pattern, but their level does not seem to differ from the other treatments. More details are provided by the following box plot (figure 4.5).

Figure 4.5: Average Payoff per Treatment



The mean in the treatment *chat* is higher than in the treatment *couple*, but what is more interesting is that the highest mean value is associated to the *baseline*. As already explained, responsibility for others has the effect of increasing efficiency, thus we can use a one-tailed Wilcoxon-Mann-Whitney test on groups' average values across rounds, which confirms that the individual average payoff is, indeed, higher in treatments *baseline* (p-value = 0.0559) and *chat* (p-value = 0.0580) rather than in *couple*.

This finding is particularly relevant as it suggests that, in our experimental setting, leadership can be used to enhance social welfare only in presence of communication; in fact, in spite of having contributed more on average, subjects in the *couple* treatment had up a significant part of their group's welfare in order to actively sustain cooperation.

4.3.4 Chat

In the treatment *chat*, *followers* were allowed to send brief messages to the *drawn participant* they were paired to. 67.19% of the 64 *followers* has used the chat at least once during the 20 rounds, for a total number of messages equal to 554. We have categorized these into 5 types of communication: suggestions to increase or decrease the contribution, suggestions to increase or decrease the punishment, and other messages. In addition to this, we checked whether the message was effective by monitoring *drawn participants*' behavior in the following round; we decided to leave aside messages of the category *other*, as their efficacy cannot be categorized and their content is not aimed to influence leaders' decisions. Table 4.2 provides data of the analysis.

TABLE 4.2: Chat

	Effective		
Message	**No**	**Yes**	**Total**
increase contribution	28	97	125
decrease contribution	21	63	84
increase punishment	7	12	19
decrease punishment	8	31	39
Total	64	203	267

In details, 36% of the total number of messages analyzed in table 4.2 suggested, successfully, to increase the contribution (against 10% suggesting a decrease). The number of messages related to punishment is, in general, lower, but it is still possible to observe how the 24% of those led to a decrease in punishment.[7]

The overall effectiveness rate is equal to 76%, which suggests that *drawn participants*' actions were partly driven by their peers' suggestions. This is particularly relevant as it seems, looking at our results, that the use of chat helped manage resources more carefully; in fact, in the treatment *couple* we do observe higher contribution, but the use of punishment is so high that it jeopardizes any benefit.

Result 4.5 Followers *communicate using the chat and this affects the decision maker.*

4.3.5 Regressions

Table 4.3 presents three models the determinants of the dependent variable *individual contribution* of two models obtained from a Arellano Bond regression: the use of this model is required by the dynamic nature of our experimental data.

[7]We ran Z-tests on proportions to compare, respectively, messages suggesting to increase or decrease contribution, and messages suggesting to increase or decrease punishment: both tests rejected the null hypothesis.

Model 1 contains two dummy variables, *treatment couple* and *treatment chat* (respectively referred to the treatments we applied), a time variable, *round*, and five lagged variables: *contribution t-1* is the individual contribution, *group average contrib t-1* is the group average contribution, *given punishment t-1* and *received punishment t-1* are the punishments given and received, and *group antisocial t-1* is the group average antisocial punishment.

Model 2 has the same body, but we added four control variables: *gender* and *age* are demographic information, *major* is a dummy variable equal to 1 if the subject is a student of the faculty of Economics,and *experience* is the number of experiments at which the subjects had taken part.

Treatment Chat only refers to leaders' contribution in the treatment with communication, and includes two dummy variables: *chat increase contrib t-1* indicates that the leader, at the end of the previous round, has received a message by her follower, suggesting to increase their couple's contribution; *chat decrease contrib t-1* indicates that the leader, at the end of the previous round, has received a message by her follower, suggesting to decrease their couple's contribution. These variables are equal to one only when messages were successful, i.e. when leaders adapted their contributions according to the messages received.[8]

[8] See section *Chat* for more details.

TABLE 4.3: Leader's Contribution Determinants - Arellano Bond Model

	Model 1	Model 2	Treatment Chat
Individual Contribution			
treatment couple	$0.277\ (0.11)^{*}$	$0.220\ (0.12)$	
treatment chat	$0.262\ (0.11)^{*}$	$0.491\ (0.12)^{*}$	
round	$-0.026\ (0.01)^{**}$	$-0.023\ (0.01)^{*}$	$-0.036\ (0.02)^{*}$
contribution t-1	$0.194\ (0.02)^{***}$	$0.188\ (0.02)^{***}$	$0.405\ (0.03)^{*}$
group average contrib t-1	$0.752\ (0.02)^{***}$	$0.755\ (0.02)^{***}$	$0.546\ (0.03)^{***}$
given punishment t-1	$-0.009\ (0.02)$	$0.000\ (0.02)$	$-0.038\ (0.03)$
received punishment t-1	$0.060\ (0.03)^{*}$	$0.064\ (0.03)^{*}$	$-0.028\ (0.05)$
group antisocial t-1	$-0.006\ (0.00)$	$-0.006\ (0.00)$	$0.011\ (0.01)$
gender		$0.100\ (0.09)$	$-0.184\ (0.15)$
age		$-0.028\ (0.02)$	$-0.060\ (0.04)$
major		$-0.332\ (0.09)^{***}$	$-0.243\ (0.17)$
experience		$0.064\ (0.01)^{***}$	$0.081\ (0.03)$
chat increase contrib t-1			$3.180\ (0.30)^{***}$
chat decrease contrib t-1			$-2.969\ (0.36)^{***}$
cons	$0.820\ (0.15)^{***}$	$1.225\ (0.48)^{*}$	$2.455\ (0.98)^{*}$
Number of obs.	4104	4104	1216
Wald Chi-sq	15146.18	15324.55	6145.03

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

treatment couple and *treatment chat* are dummies indicating the treatment applied, *contribution t-1* is the individual contribution in the previous round, *group average contrib t-1* is average contribution by group in the previous round, *given punishment t-1* is the punishment subject used in the previous round, *received punishment t-1* is the punishment subject received in the previous round, *group antisocial t-1* is the average antisocial punishment used in the previous round by the group, *experience* is the number of experiments the subjects took part to, *chat increase contrib t-1* and *chat decrease contrib t-1* indicates whether leaders received a successful message suggesting, respectively, to increase or decrease their contribution.

In general, our models seem not to differ widely both in terms of parameters and their significance. The treatments dummy variables are both significant in Model 1, supporting the idea that leadership has the effect to increase contribution in our experimental setting. In Model 2, the dummy related to the treatment *couple* loses significance: this may be caused by the larger number of independent variables included.

The variable *round* has a negative coefficient in all the models, and this seems to conflict with the trend observed in figure 4.1; nevertheless, as the lagged individual contribution variable is always positive, the presence of a negative parameter related to the variable *round* suggests that there is a flattening in contributions as the game proceeds.

The average group contribution in the previous round positively affect individual contributions, so that, to some extent, we could say that cooperation sustains itself. Similarly, in models 1 and 2 punishment received in the previous round has a positive effect on individual contribution. This effect is not observed in the treatment *Chat*: an explanation can be found in the high significance of the coefficient related to the variable *chat decrease contrib t-1*. This suggests that followers' messages were taken into account by leaders, even when causing the couple to incur punishment.

In addition to this, we find that also the coefficient of the other dummy variable related to chat, *chat increase contrib t-1*, is highly significant, supporting our result that points out the efficacy of the use of communication between followers and leaders.

For as regards our control variables, we only observe significant effects in Model 2: Economics students tend to contribute less than others, while people with more experience in laboratory experiments contribute more to the Public Good.

4.4 Conclusion

Following some recent work aimed to study leadership and cooperation (Hamman, Weber, and Woon, 2011; Bolle and Vogel, 2011; Güth et al., 2007), we test in a laboratory experiment the effects of leadership on intra-group cooperation, combining this condition with delegated choices. Specifically, we investigate whether leadership is beneficial when, in addition of being responsible for others, leaders are also asked to cooperate among themselves. This aspect is particularly interesting and, at the best of our knowledge, have not been tested experimentally yet. Furthermore, we compare a situation where leaders decide independently to another where their followers are allowed to send short messages.

Our main finding is that, when there is no communication, leaders tend to contribute more to the public good, but also to make an undue use of punishment; the latter aspect is true when referring to both *altruistic punishment* and *antisocial punishment*. When *followers* are allowed to communicate with their leaders, providing their opinion about the choices made in the round just concluded, it is possible to observe a decrease in contributions and punishment, such that they do not significantly differ from the average ones observed in our baseline.

In terms of final payoffs, although *leaders* contribute and cooperate more in the treatment *couple*, we observe, on average, higher earnings in the baseline and in the treatment *chat*. This result suggests that the responsibility for others that *leaders* perceive when contributing to determine others' payoffs incentivizes them to cooperate more, but also to punish more, with the aim of preventing other leaders from compromising their effort. Nevertheless, punishment is used without considering the consequences, so that the effects of higher contributions are jeopardized.

From this perspective, it is possible to reduce punishment[9] and obtain higher final payoffs providing followers with the possibility of communicating with leaders they are matched with. We find that results from the treatment with leadership and communication produces very similar results to the public good game with punishment we use as baseline.

This evidence suggests that leadership itself may be, in some cases, more harmful rather than beneficial; in fact, decision makers, moved by their sense of responsibility for others', seem not to be always able to correctly decide. When followers have *voice*, leaders tend to be less aggressive because communication works as a trigger that relieves the psychological pressure of responsibility (Xiao and Houser, 2009; Ellingsen and Johannesson, 2008): this, in our case, reduces the use of punishment and produces an increase in efficiency.

To summarize, we can conclude that, in our experimental setting, a normative leadership where leaders have dictatorial power increases, on average, contributions to the public good, but, because of leaders' aggressiveness in the use of punishment, does not produce beneficial effects on final payoffs. On the other hand, implementing a "weakened dictatorship" where communication is allowed, it is possible to obtain meaningful results in terms of both cooperation and efficiency, preventing waste of resources deriving from individual aggressiveness.

[9] As explained in the section *Punishment*, the treatment *chat* does not significantly differ from the treatment *couple*; yet, as observed in figure 4.3, the number of points assigned seems to be smaller.

Our experimental results are interesting as they contribute to an unexplored dimension, shedding light on leaders' interaction and responsibility for others in a cooperation game. Nevertheless, it is important to keep in mind that we only provide a preliminary analysis. Further experiments should aim to investigate the interaction between leaders in order to provide useful insights and find how a greater cooperation could be achieved: this aspect could be relevant also for purposes regarding external validity.

4.5 Appendix - Experimental Instructions

Following we include an English translation of the experiment instructions. Our experimental design required us to produce three different version of the instructions (i.e. one for each treatment). General instructions were common, while instructions for the remaining part of the experiment were edited to match the structure of our treatments.

As explained in the section on the experimental task, the main differences in our experiment occur between the *baseline* and the treatments *couple* and *chat*. These latter, in fact, do not differ much from each other.

What follows is a full version of the instructions we used for the experimental sessions. Any time there will be an edited part, it will be noticed, specifying to which treatment we are referring (*baseline*, *couple*, or *chat*). May the instructions be common to all the treatments, this will indicated as well (*common*).

General Instructions

[*common*] Good morning, thanks for having accepted to participate to this experiment. You are taking part to a study on decisions in the economic environment. During the experiment you will have the opportunity to gain money. At this sum we will add 3 euros for your participation. Your payment will depends on your decisions and on other participants' decisions. The answers you give and the choices you make will be absolutely anonymous. The experimenters will not be able to associate your choices and your answers to your name. During the whole experiment we kindly ask you not to communicate with the other participants (otherwise, you will be excluded from the experiment) and to pay attention to the instructions that will be shown on your monitor and will be read aloud by one of the experimenter. May you have any question, ask the experimenters.

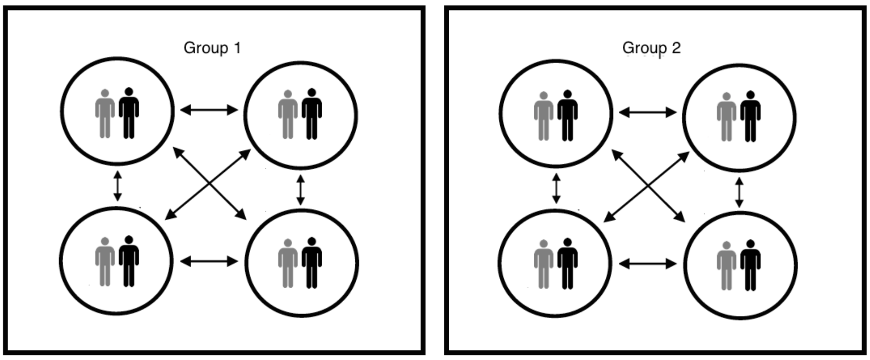
[*common*] Your payoff will be calculated in tokens: each token corresponds to 2 euro cents. At the end of the experiment we will ask you to fill a short questionnaire and we will proceed to the payment, that will be made in cash.

THE PARTICIPANTS

[*baseline*] Participants to the experiment are divided into 4 groups. The composition of groups is the same during the whole experiment. Thus, your group will be composed, in addition to you, by other three persons, whose identity you will not know.

[*couple*, *chat*] This experiment has 16 participants, divided into 8 couples. The composition of couples remains the same during the whole experiment. Thus, your couple will be made by you and another person, whose identity will remain unknown to you. In every couple, one of the participants will be randomly assigned the role of *drawn participants*. The *drawn participant* in your couple will interact with the *drawn participants* of other three couples according to the procedure described below. Your couple belongs to a group consisting of four couples. These groups are two, and their composition remains unchanged during the whole experiment (Figure 4.5.1).

FIGURE 4.5.1: Group Structure



[*common*] The experiment is divided into 20 rounds. In each round the other member of the group will not be identified by any name, so that their choices cannot be identified either.

THE PHASES

Each round is composed of **2 phases**.

Phase 1

[*baseline*] At the beginning of each round every participants receives 20 tokens. We will call this sum "endowment". You will have to decide how to use your endowment. In particular you will have to decide ow many of the 20 tokens to utilize to contribute to a project and how many you of them you want to keep for yourself. The other members of the group will have to do the same.

The tokens invested in the project will be multiplied by a yield of 1.6 and equally divided between the 4 members of the group.

At the end of phase 1, you will be given information about your earning, that consists of two elements:

A The part of the initial 20 tokens that you decided to keep for yourself (meaning 20 tokens minus the contribution to the project);

B Your payment deriving from the project, which is equal to 40% of the sum of the four members' contributions.

Then, your earning at the end of phase 1 is computed by the computer as follows:

Your earnings at the end of phase 1 =
(20 tokens - contribution to the project) +
40% * (members' total contribution to the project)

[*couple*, *chat*] At the beginning of each round every participants receives 40 tokens. We will call this sum "endowment". The drawn participant of each couple has to decide how to use your endowment. In particular she will have to decide ow many of the 40 tokens to utilize to contribute to a project and how many you of them you want to keep for yourself. The other members of the group will have to do the same.

The tokens invested in the project will be multiplied by a yield of 1.6 and equally divided between the 4 couples of the group.

At the end of phase 1, you will be given information about your couple's earning, that consists of two elements:

A The part of the initial 40 tokens that the drawn participant decided to keep for your couple (meaning 40 tokens minus the contribution to the project);

B Your payment deriving from the project, which is equal to 40% of the sum of the four couples' contributions in your group.

Then, your earning at the end of phase 1 is computed by the computer as follows:

Your couple earnings at the end of phase 1 =
(40 tokens - contribution to the project) +
40% * (couples' total contribution to the project)

[*baseline*] Each group member's earnings are computed in the same way; furthermore, each couple receives the same payment from the project.

[*couple*, *chat*] Each couple's earnings are computed in the same way; furthermore, each participant receives the same payment from the project.

[*baseline*] Imagine, for instance, that in your group one member contributes with 10 tokens, another contributes with 8 tokens, a third member contributes with 12 tokens and you decide to contribute with 10 tokens. The total group contribution is then 40 tokens. So, each member of the group receives from the project a sum equal to 40% of 40 tokens = 16 tokens. The earnings for the 4 members will be:

- first participant: $20 - 10 + 16 = 26$
- second participant: $20 - 8 + 16 = 28$
- third participant: $20 - 12 + 16 = 24$
- fourth participants: $20 - 10 + 16 = 26$

[*couple*, *chat*] Imagine, for instance, that in your group the *drawn participants* of the first couple contributes with 10 tokens, the second couple's one contributes with 8 tokens, the third couple's one contributes with 12 tokens and your couple's *drawn participants* decides to contribute with 10 tokens. The total group contribution is then 40 tokens. So, each couple of the group receives from the project a sum equal to 40% of 40 tokens = 16 tokens. The earnings for the 4 couples will be:

- first couple: $40 - 10 + 16 = 46$
- second couple: $40 - 8 + 16 = 48$
- third couple: $40 - 12 + 16 = 44$
- fourth couple: $40 - 10 + 16 = 46$

[*common*] The software will always display the number of the current round and the earnings accumulated until that moment.

Phase 2

[*baseline*] At the beginning of Phase 2 you can observe how much the other group members have contributed to the project. At this point each member of the group can decide to reduce or leave unvaried other members' phase 1 earnings, by assigning points, up to a maximum of 10 points. Each of the point assigned reduces by 10% the phase 1 earnings of the participant who receives it. Thus, if you decide to assign 0 points to another group member, you will not modify that participant's earnings. If you assign 1 point you will reduce that participant's earnings by 10%. If a person receives in total 4 points, her phase 1 earnings will be reduced by 40%. If the person receives 10 or more points her earnings will be reduced by 100%. Assigning points has a cost, which depends on the number of points you decide to assign.

The table shows the correspondence between the number of points assigned and the cost to pay.

POINTS	0	1	2	3	4	5	6	7	8	9	10
COST	0	1	2	4	6	9	12	16	20	25	30

For instance, if you decide to assign 1 point to a member of your group and 3 points to a second member, the earning of the first person will be reduced by 10% while the earning of the second will be reduced by 30%. The cost you have to pay in total is equal to 1 token (for 1 point) + 4 tokens (for 3 points).

Your earning at the end of Phase 2 is computed as follows:

Your earnings at the end of Phase 2 =
earning at the end of Phase 1 -
cost of points assigned in Phase 2 -
0.10 * (points received in Phase 2) *
(earning at the end of Phase 1)

Note that if you receive 10 points, your earning in Phase 1 will be reduced by 100%. The maximum reduction is, anyways, equal to 100%, also in the case you received more than 10 points. Note also that at the end of Phase 2 your earning can be negative. This happens when the cost of the points you have decided to assign is higher than your earning. If you pay attention it will not be hard to avoid this.

[*couple*, *chat*] At the beginning of Phase 2 you can observe how much the other couples have contributed to the project. At this point each *drawn participants* can decide to reduce or leave unvaried other couples' phase 1 earnings, by assigning points, up to a maximum of 10 points. Each of the point assigned reduces by 10% the phase 1 earnings of the couple that receives it. Thus, if the *drawn participants* decides to assign 0 points to another group member, she will not modify that participant's earnings. If she assigns 1 point she will reduce that participant's earnings by 10%. If a couple receives in total 4 points, its phase 1 earnings will be reduced by 40%. If the couple receives 10 or more points its earnings will be reduced by 100%. Assigning points has a cost, which depends on the number of points the *drawn participants* decides to assign.

The table shows the correspondence between the number of points assigned and the cost to pay.

POINTS	0	1	2	3	4	5	6	7	8	9	10
COST	0	2	4	8	12	18	24	32	40	50	60

For instance, if the *drawn participants* decides to assign 1 point to a couple of your group and 3 points to a second couple, the earnings of the first couple will be reduced by 10% while the earnings of the second will be reduced by 30%. The cost your couple has to pay in total is equal to 2 token (for 1 point) + 8 tokens (for 3 points).

Your couple's earnings at the end of Phase 2 are computed as follows:

Your couple's earnings at the end of Phase 2 =
earning at the end of Phase 1 -
cost of points assigned in Phase 2 -
0.10 * (points received in Phase 2) *
(earning at the end of Phase 1)

Note that if your couple receives 10 points, Phase 1 earnings will be reduced by 100%. The maximum reduction is, anyways, equal to 100%, also in the case your couple received more than 10 points. Note also that at the end of Phase 2 your couple's earnings can be negative. This happens when the cost of the points the *drawn participants* have decided to assign is higher than your couple's earnings. If you pay attention it will not be hard to avoid this.

[*common*]Any negative payoff at the end of the experiment will be balanced by using your show-up fee, which will then be reduced by an amount equal to the suffered loss. May the loss be higher than the show-up fee your payment at the end of the experiment will be equal to zero.

[*couple*, *chat*] THE NOT-DRAWN PARTICIPANTS

[*couple*, *chat*] During the experiment the members of the couples who have not been drawn as *drawn participants* will observe the choices of their *drawn participants* and will obtain information about the other couples' contribution level and about assigned and received points. In addition to this, during every round they will be asked to express their choices as if they where *drawn participants*, both in terms of contribution and points giving.

[*chat*] Furthermore, at the end of every round they will have the opportunity to send a message to the *drawn participants*. The message will have to be inherent to the experiment activity, and shall not contain information that may reveal the sender's identity, nor offensive and rude statements.

FINAL PAYMENT

[*baseline*] At the end of the experiment you will be informed about your total payment, to which it is added the 3 euros participation fee.

[*couple*, *chat*] At the end of the experiment you will be informed about your couple's total payment. Your personal payment will correspond to half of that sum, to which it is added the 3 euros participation fee.

CONTROL QUESTIONS

[*baseline*]

1. Participants are divided into groups of .... people each.
2. The composition of groups remains the same during the whole experiment, so you will always interact with the same people. [ ] True [ ] False
3. Phase 1: your contribution is equal to 10 tokens and other group members' contributions are: 10, 5, 0. Your earning will be: ....
4. If your earning in Phase 1 is equal to 20 tokens and you receive 5 points, your earning will be then equal to: ....
5. If you assign to the other three members of your group the following points: 2, 3, 5, the total cost of the points will be equal to: ....

[*couple*, *chat*]

1. Participants are divided into .... couples and .... groups.

2. Your couple interacts with other .... couples.

3. The composition of groups remains the same during the whole experiment, so your couple will always interact with the same couples. [ ] True [ ] False

4. Phase 1: your couple *drawn participant*'s contribution is equal to 10 tokens and other couple *drawn participants*' contributions are: 20, 10, 0. Your couple's earning will be: ....

5. If your couple's earning in Phase 1 is equal to 30 tokens and you receive 5 points, your couple's earning will be then equal to: ....

6. If the *drawn participant* assigns to the other three couples of your group the following points: 2, 3, 5, the total cost of the points will be equal to: ....

4.6 Appendix - Data

Following, we provide mean values of the most relevant variables used for our analysis (Table 4.6.1). Data are organized by treatment and by group.

Table 4.6.1: Individual Average Values per Group

Treatment	Group	Contribution (SD)	Punishment (SD)	Payoff (SD)
baseline	1	16.688 (3.922)	.500 (.827)	27.740 (3.535)
baseline	2	18.225 (3.114)	.275 (.616)	29.741 (2.594)
baseline	3	3.775 (3.822)	.500 (.914)	20.544 (3.135)
baseline	4	3.375 (3.491)	.163 (.462)	21.454 (3.272)
baseline	5	5.975 (2.199)	.313 (.587)	22.488 (2.375)
baseline	6	1.675 (3.133)	.663 (1.330)	18.852 (3.122)
baseline	7	12.113 (2.506)	.475 (1.055)	25.798 (2.521)
baseline	8	15.275 (4.503)	2.800 (2.291)	17.570 (3.634)
baseline	9	14.013 (5.290)	2.138 (2.448)	19.1753 (9.737)
baseline	10	14.588 (4.995)	2.975 (2.873)	16.656 (8.186)
baseline	11	2.213 (3.883)	.913 (1.995)	18.028 (3.949)
baseline	12	3.788 (3.828)	.288 (.7826)	21.202 (3.399)
baseline	13	15.988 (4.295)	.513 (1.043)	27.179 (4.973)
baseline	14	7.100 (3.407)	3.463 (3.987)	11.119 (5.362)
baseline	15	9.913 (5.171)	.363 (.917)	24.511 (4.578)
baseline	16	8.375 (6.097)	.600 (1.308)	22.519 (4.239)
baseline	17	10.150 (2.141)	.438 (.869)	24.419 (2.936)
baseline	18	10.125 (5.931)	1.738 (2.249)	19.097 (5.325)
couple	19	3.263 (3.265)	.375 (.848)	20.666 (2.391)
couple	20	15.688 (3.360)	.238 (.601)	28.421 (2.963)
couple	21	17.625 (3.895)	.038 (.191)	30.413 (3.213)
couple	22	10.750 (8.511)	4.225 (4.466)	9.577 (15.430)
couple	23	7.706 (1.950)	1.475 (1.534)	19.526 (3.542)
couple	24	15.588 (5.539)	1.650 (1.700)	22.678 (5.779)
couple	25	18.463 (4.612)	.813 (2.007)	27.266 (7.559)
couple	26	18.875 (3.643)	.400 (1.481)	29.584 (4.877)
couple	27	10.994 (3.820)	2.913 (3.273)	15.215 (7.223)
couple	28	8.856 (5.423)	3.088 (3.562)	13.183 (8.459)
couple	29	7.250 (5.426)	3.200 (3.395)	12.089 (9.053)
couple	30	9.988 (1.859)	1.475 (2.289)	20.524 (5.090)
couple	31	18.888 (3.163)	2.038 (2.957)	22.200 (12.079)
couple	32	9.725 (7.382)	2.100 (3.197)	17.541 (10.593)
couple	33	5.575 (1.553)	1.275 (1.902)	18.874 (4.234)
couple	34	2.781 (1.064)	2.363 (1.640)	14.053 (3.614)
couple	35	18.606 (3.066)	3.975 (5.463)	6.442 (7.518)
couple	36	5.000 (4.842)	5.000 (6.138)	1.114 (8.064)
couple	37	18.350 (2.611)	.925 (1.290)	13.581 (1.997)
couple	38	16.019 (4.653)	1.275 (1.842)	11.852 (4.050)

Treatment	Group	Contribution (SD)	Punishment (SD)	Payoff (SD)
chat	39	3.850 (3.397)	.238 (.846)	21.473 (3.620)
chat	40	5.644 (2.394)	1.575 (2.061)	17.904 (5.413)
chat	41	15.294 (5.140)	1.150 (2.820)	24.297 (9.339)
chat	42	3.400 (1.811)	.325 (.652)	20.958 (1.855)
chat	43	18.419 (4.448)	1.163 (3.671)	25.125 (14.674)
chat	44	12.769 (4.474)	.125 (.644)	27.139 (3.889)
chat	45	16.525 (5.798)	1.288 (2.404)	24.425 (10.090)
chat	46	16.519 (5.376)	1.863 (3.575)	22.079 (14.260)
chat	47	14.256 (5.173)	2.738 (4.078)	16.873 (10.983)
chat	48	6.825 (2.278)	.488 (.729)	22.318 (2.131)
chat	49	6.475 (2.544)	.675 (1.868)	21.149 (6.381)
chat	50	14.975 (6.314)	1.638 (1.989)	22.117 (7.492)
chat	51	4.606 (1.588)	.538 (.745)	20.899 (2.632)
chat	52	16.588 (4.950)	1.063 (1.503)	25.762 (6.908)
chat	53	10.238 (3.825)	2.500 (2.837)	16.332 (8.212)
chat	54	7.638 (2.940)	3.488 (4.704)	10.635 (11.153)

Chapter 5

Concluding Remarks

The work presented in this dissertation focuses on the effects that responsibility for others has on individuals in different decisional settings. It is possible to divide the thesis into two parts: the first provides an overview of some of the most relevant contributions to the literature, collecting the experimental data and presenting an aggregate analysis; the second part consists of two independent experimental studies on delegated decision making under risk, and leadership in cooperation, respectively. The literature analysis portrays a clear and precise picture of the state of the art, while the experimental method allows to disentangle specific phenomena that would be, otherwise, complicated to observe outside a controlled environment.

Following, I summarize the main findings of the dissertation, provide an overview of the possible implications and limitations, and suggest how the experiments presented could be extended for future research.

5.1 Main Findings and Implications

Chapter 2 presented an analysis focused on three different decisional settings with delegation: dictator games, delegated decision making under risk, and leadership in cooperation.

Regarding dictator game, I summarized the exhaustive meta-analysis by Engel (2011) and presented his main findings. Results from the analysis point out that, on average, individuals playing a dictator game share 28.35% of their endowment with the recipients they are paired with. A part from this, the author stresses the importance of specific experimental factors, explaining how these can affect dictators willingness to give.

In particular, Engel distinguishes between factors increasing the amount given to recipients, and factors reducing dictators' offers. Among the first, it is possible to find the presence of multiple recipients, the fact that recipients can be considered deserving, old dictators, or recipients who earned their shares. On the other hand, among the factors that affect negatively dictators' offers, the author recognizes the presence of more dictators who decide together, recipients who already have a certain welfare, low degrees of social proximity between dictators and recipients, young dictators, and repeated games.

Generalizing his findings, Engel suggests that, taking into account the heterogeneity of results emerged from his analysis, one should consider experiments on dictator games as mainly explorative, and use them to obtain more information about the heterogeneity of individuals' allocation preferences.

The second part of the literature analysis drove the attention to delegated decision making under risk, corresponding to risky decisions that have consequences on others' money. Studies in this field point out various results in terms of discrepancies between risky decision making for self and others, which might be due to some idiosyncratic factors of the experimental settings. Specifically, the great majority of the studies I have considered report an increase in risk aversion when people decide on behalf of someone else: this finding is clearly supported by studies adopting the BDM, and the GP task. However, this does not always hold when other procedures are implemented. As a matter of fact, researches relying on the use of Multiple Price Lists or on the estimation of the Certainty Equivalent (BDM excluded) report a mixture of results in the extent of risk-taking for others. In my analysis, it emerges how the heterogeneity of task features might affect risk-taking: for instance, simply plotting risk preferences on a common scale (Crosetto and Filippin, 2015), it is possible to notice how the various tasks capture differently individual risk preferences. Finally, I argue that it is necessary to consider individual preferences as a possible determinant of the discrepancy between self and other risk-taking.

The last part of *Chapter 2* focused on leadership in cooperation. In general, the implementation of leadership fosters contribution to the public good, and it seems there is no evidence of any negative effect. This is true being the leader a simple coordinator, a person advising other group members, or a dictator. One explanation to this phenomenon could be the moral pressure produced by responsibility for others.

However, even if leadership produces an increase in contributions in all the considered studies, it is still possible to identify few experimental features affecting negatively this increase. These are altruistic punishment, the size of groups (apart from groups with 4 members), and a number of repetitions greater than 20.

It follows that the concluding remarks by Engel (2011) also hold in the domains of delegated decision making and leadership in cooperation, so that, when designing an experiment, one has to be aware of the fact that single factors could be relevant in determining decision makers' choices; furthermore, specific experimental settings can be used to disentangle and analyze particular human behaviors.

Chapter 3 moved the focus on delegated decision making under risk and addressed three specific research questions: i) do individuals use more resources to offset risk when accessing others' resources rather than own resources? ii) Do individuals use more resources to offset risk borne by themselves rather than by others? iii) Do individuals offset risk differently when choosing for themselves rather than when delegated to choose for others?

The experiment designed to answer these questions allowed to manipulate at the same time the dimensions of risk and resources. Behaviors observed in the experiment were assessed against predictions were from the linear model for social preferences by Charness and Rabin (2002). Although the linearity of the model is a simplification, results provided support to its prediction power under the experimental conditions applied .

Specifically, experimental evidence show that (i) individuals invest more in risk protection when someone else provides the required resources, but, at the same time, (ii) when individuals directly bear the cost of risk protection, they invest less to protect others than to protect themselves. Furthermore, (iii) individuals tend, when delegated to decide for others, to invest more in risk protection than when choosing for themselves.

What seems to emerge from this experimental analysis is that differences between investment in risk protection for the decision maker and other individuals can be largely predicted relying on their social preferences; in particular, people showing difference-averse preferences, on average, invest more resources in risk protection than individuals with preferences for the welfare-enhancement. The main explanation to this, as pointed out by Linde and Sonnemans (2012), is given by the fact that difference-averse types have a lower utility when, in terms of payoffs, they lag behind others.

The most important implication of this study is the emerged importance of individuals' distributional preferences in delegated decision making under risk. Standard self-centered utility models are not helpful in this domain, as they do not take into account what should be the curvature of others' utility function. This study sets aside the problems related to the utility curvature, focusing, instead, on other regarding concerns; this produces clear-cut predictions.

Chapter 4 drove the attention to implications of leadership in cooperation, using as experimental setting a public good game. The investigation had the aim of understanding whether leadership is beneficial when, in addition of being responsible for others, leaders are also asked to cooperate among themselves. In addition to this, there was an additional treatment where followers were allowed to communicate to leaders their opinion on the choices made during the round just passed.

Experimental results showed that, when there is no communication, leadership causes an increase in contributions to the public good, but also an increase in the use of both *altruistic punishment* and *antisocial punishment*. When communication with leaders is allowed, instead, results show that contribution and punishment are, in general, lower, and not significantly different from what observed in the baseline.

Regarding final payoffs, although leadership increases the average contribution level, the undue use of punishment jeopardizes the benefits of this increase. This result suggests that the responsibility for others' payoff incentivizes leaders to try to prevents other players from comprising payoffs of their own group punishing more; but their attempt and excess of aggressiveness generally cause a reduction of average payoffs.

In this sense, the use of communication is beneficial, as leaders seem to perceive an alleviation of the psychological pressure of responsibility, which helps them reduce the use of punishment, obtaining an increase in final payoffs.

It is important to underline how, average payoffs under the communication condition are not statistically different from the ones in the baseline.

This suggests that, in the experimental setting used, dictatorial powers, on average, increase contributions but not payoffs; a democratic approach where followers can express their opinions to leaders leads to higher cooperation and efficiency, preventing a possible waste of resources deriving from psychological pressure and individual aggressiveness.

5.2 Limitations and Further Research

Experimental economics have been mainly criticized because some consider results obtained in the laboratory as simple indicators of real individuals' behavior. Levitt and List (2007) explain that, despite the number of authors utilizing the experimental approach has been growing during the last decades, when taking part to laboratory experiments[1], individuals are framed into an artificial setting diverging from naturally-occurring environments.

On the other hand, some authors (Levin et al., 1983, and Brookshire, Coursey, and Schulze, 1987 among the others), address results from field experiments against data on individuals' behavior obtained in laboratory experiments, and report evidence of the external validity of the latter, supporting the idea that laboratory results provide more than simple indications.

Anyway, Guala and Mittone (2005) clarify the distinction between external validity and the robustness of phenomena observed in the laboratory. In fact, most of the criticisms made to experimental procedures address the problem deriving from differences between an artificial environment and the real world, without considering the robustness of phenomena observed during experiments. Authors using the experimental approach has never argued that behaviors observed in the laboratory fully correspond to people's behavior in everyday life; they, instead, interpret significant results as insights of the natural human decisional process.

Once clarified this methodological issue, it is possible to focus on the limitations of the single studies presented in this thesis, and to explain how further

[1]In particular, Levitt and List (2007) focus on experiments aimed to investigate social preferences.

research on the phenomena investigated could help improve and strengthen the findings obtained.

Regarding the analysis on leadership in cooperation conducted in *Chapter 2*, the main limitation could be considered the fact that, in order to build the pooled dataset starting from different studies, there was the need to normalize all the experimental results. Together with the fact that, in meta-studies, it is practice to analyze articles based on different experimental settings, and aimed to investigate similar, but yet different, research questions, this can produce general results that are not completely reliable, but provide a sufficient overview of the state of the art in a field of literature.

In order to increase results reliability, it would be helpful to extend the purpose of the analysis: a broader meta-study might consider experiments involving public goods game in general, instead of focusing only on those implementing leadership. This would allow to compare leadership (or, specifically, different types of leadership) to other independent treatment factors affecting cooperation.

Chapter 3 has evidenced the importance of allocation preferences in situations where individuals are delegated to make risky choices for others. Evidence presented can be considered a starting point for further research in this area; in fact, if results pointed out the predictive reliability of a pure model for social preferences, on the other hand it is important to keep in mind that the one used was a linear simplification. From this perspective, next studies should try to draw the attention to the model to use to obtain behavioral predictions, so that curvatures of individuals' utility functions can be taken into account.

Chapter 4 investigated the effect of leadership in a between-leaders public good experiment, where decision makers play under strategic interaction and are responsible for another person. Results evidence how, from an efficiency point of view, it is better to implement leadership leaving to followers the possibility to express their opinions. Nevertheless, it would be interesting to allow a two-sided communication, in order to observe how leaders would behave under that condition; in fact, it seems that when followers communicate with leaders, the psychological pressure they have because of the sense of responsibility for others is partly mitigated, but there may be some unobserved factors that could be captured from a reciprocal exchange of messages.

In addition to this, the group structure is really simple: there are couple of players, divided into a leader and a follower. Further research should investigate how, manipulating the number of leaders and followers can affect cooperation and efficiency in a similar experimental setting.

Although the studies described in this dissertation present some limitations from a methodological point of view and can be considered preliminary explorations, they provide precise answers to specific research questions, and contribute to enrich the knowledge about individual decision making and socially oriented behaviors, providing a starting point for further research.

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