CAN CONTEXT EFFECTS MITIGATE BEHAVIOR THAT CAUSES NEGATIVE EXTERNALITIES? AN EXPERIMENTAL INVESTIGATION

by

Jubo Yan

A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Master of Science in Agricultural and Resource Economics.

Summer 2010

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Approved: _____
Kent D. Messer, Ph.D.
Professor in charge of thesis on behalf of the Advisory Committee

Approved: _____
Thomas W. Ilvento, Ph.D.
Chair of the Department of Food and Resource Economics

Approved: _____
Robin W. Morgan, Ph.D.
Dean of the College of Agricultural and Natural Resources

Approved: _____
Debra Hess Norris, M.S.
Vice Provost for Graduate and Professional Education

ACKNOWLEDGMENTS

First of all, I want to take this chance to give my special thanks to Dr. Kent Messer - my advisor at University of Delaware. In the past two years, I have learned a lot about experimental economics and gained lots of experience from working with him. Dr. Messer not only advised me to conduct research but also taught me how to achieve success step by step in the academic world. This is my first two years in the US and first time to conduct research so I really appreciate the support from Dr. Messer. His enthusiasm on research has deeply impressed me and also helped me to strengthen my willingness to be a researcher.

I also want to appreciate the help from other faculty members in the FREC department at University of Delaware. Dr. Joshua Duke and Dr. Jong soo Lee served as my committee members and provided many valuable suggestions on my thesis. Dr. Thomas Ilvento gave us endless support to ensure our success. Dr. Titus Awokuse taught me many things about being successful in graduate school. Dr. Jordan Suter from Oberlin College has put a lot of effort on our project and offered many invaluable suggestions on my thesis.

At last, I hope to thank my parents for their support on my study in the US. I have been away from home for many years and they have always been supportive whatever my choice is. My friends and fellow graduate students who work with me in the same office, I want to thank you all for the happiness you brought to me in the last two years.

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ABSTRACT

Self-interested behavior can be detrimental to the public good when an individual or firm making a decision is not fully responsible for the cost of that decision to society, therefore acting as a free-rider. This disconnection between decisions and their costs to society underlies many modern environmental, public health, and social problems. Examples include air and water pollution, climate change, and overuse of common pool resources. Under the framework of traditional economics, governments can "internalize" relevant costs. However, such actions may not eliminate or reduce the problems due to lack of necessary information. Behavioral economics, however, can offer a new perspective in tackling such public ills. Previous laboratory and field studies have shown that people may not behave as predicted by traditional economic theories. In this study, a "public bad" game that incorporated an externality cost was designed to examine how contextual factors affect people's behavior in a laboratory setting.

Six treatments were employed in experiments to investigate the effect of cheap talk, status quo, and voting. Each treatment was composed of six groups of seven individuals. Undergraduate students with some background in economics at University of Delaware were recruited to participate in the experiments. Thus, a total of 252 subjects were used. Relying on Andreoni (1995), I adopted negative framing to examine the framing effect.

Results from the experiment were analyzed at group and individual levels and graphs depicting the round-by-round data enable one to compare all treatments. A

Tobit model was used at the group level to study treatment effects on contributions to a group account. A Probit model was used at the individual level to study treatment effects on the probability of an individual making a full or zero contribution. Panel data techniques were employed in both models to take heterogeneity into account. The analysis showed that cheap talk can increase the contribution rate significantly, a result that is consistent with former studies. Status quo, however, had no significant effect on contributions when other contextual factors were excluded from the experiment. When other contextual factors were included, the effect of status quo varied from previous studies involving public-good games. Status quo itself could not always increase the efficiency level.

Consequently, the results of laboratory games can provide useful information for policy-makers. Communication can reduce or even overcome behaviors which cause negative externalities. Since people are more likely to contribute under positive framing than under negative framing, policy-makers who frame externality problems in terms of public good (i.e. positive externality) rather than public detriment (i.e. negative externality) should be more successful in finding practical solutions and engaging public support.

Chapter 1

INTRODUCTION

Most modern environmental, public health, and social problems originate not from the direct actions of malign individuals but indirectly from the self-interested behavior of benign people. Self-interested behavior can cause negative externality problems when an individual or firm making a decision is not fully responsible for the cost of that decision. If production or consumption of a good has a negative externality, then the cost to society is greater than the cost to the producer or consumer. Since producers and consumers make decisions based on the point at which the marginal cost equals the marginal benefit and do not take into account the cost of a negative externality, negative externalities can result in market inefficiencies unless proper actions are taken to prevent them.

In the real world, externalities cause many societal problems. Climate change, for example, is attributed to greenhouse gas emissions from burning oil, gas, and coal in support of benign household needs, but people are not fully responsible for the consequences caused by those activities. Manufacturers that release pollution into water supplies harm plants, animals, and humans. Industrial farm animal production, on the rise in the 20th century, has resulted in farms that are easier to run with fewer, often less skilled employees and a greater output of uniform animal products. However, these farms contribute to the rise in antibiotic-resistant bacteria because of their use of antibiotics in production (Weiss, 2008). Other examples include air quality problems; contamination of rivers, streams, and coastal waters with concentrated animal waste; and animal welfare

concerns based mainly on the extremely close quarters in which animals are housed (Liebowitz, 1994).

Social problems also arise when people try to make use of common pool resources. Harvesting by one fishing company in the ocean depletes the stock of fish available for other companies and overfishing may be the result. When car owners use roads, they impose congestion costs on all other users.[1]

Given the economic inefficiencies caused by such decisions, economists have long sought solutions while continuing to study the causes. Under a system of Pigouvian taxes, government can "internalize" societal costs and benefits or properly assign the property right to remove the inefficiency from the economy.

In reality, unfortunately, property rights cannot always be properly assigned and the transaction cost also prevents people from negotiating effectively (Canterbery, 1992). Also, an authority usually does not have enough information to "internalize" the externalities. Thus, government must play a crucial role in solving problems caused by market failure. The Environmental Protection Agency (EPA) was formed in 1970 to provide public-sector solutions to the problems of externalities in the environment. The agency regulates a wide variety of environmental issues in areas ranging from clean air to clean water to land management.[2]

As previously mentioned, traditional remedies from policy-makers usually fall into two categories—taxation and regulation—both requiring intervention from government. Therefore, standard economic theory offers a bleak assessment of what can be done to prevent such negative externality problem in a voluntary, noncontractual

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[1] Strictly speaking, common pool resources and pure negative externality problems are not equal because of the existence of rivalry in a common pool resource problem (CPR) but they share many features. Thus, studying such problems can also benefit the study of CPR issues. For detailed information, see Maier-Rigaud and Apesteguia (2004) and Brewer and Kramer (1986).

[2] http://www.epa.gov/epahome/aboutepa.htm. Other agencies are also involved in protection of environmental and natural resources, such as the U.S. Department of Agriculture.

framework. Furthermore, both taxes and regulations can cause distortions in the economy when viewed from a standard economic perspective. Sometimes it is impossible for an authority to accurately measure the marginal costs and marginal social costs of production with externality, prohibiting it from devising a proper tax rate to correct the problem. In addition, the government often does not have enough information to implement relevant regulations. The government incurs costs to collect necessary information and to execute regulations so the cost of taxes and regulation may offset the benefits from them. Thus, government policies are not always the best way to solve externality problems.

Behavioral economics, from another perspective, could offer new insight and propose solutions that do not require intervention from an authority. Some laboratory experiments have shown that traditional economic theories regarding the public good may be violated in the real world. Marwell and Ames (1978, 1980) randomly selected high school students as subjects and randomly assigned them to groups. All subjects were confronted with an investment opportunity. Each subject could invest resources provided by the experimenter in either a private good that returned a fixed amount of money to the individual per token invested or a public good. The experiment showed that free-riding does exist but that people contribute to public goods in a laboratory setting. Moreover, such cooperation among subjects is robust. In a later work, Marwell and Ames (1981) employed as many as 12 settings in their experiments and further bolstered their earlier conclusion: the extensive free-riding that was predicted by theory (that no one would contribute to a public good) never occurs; a limited amount of free-riding occurs when the voluntary contribution mechanism is suboptimal, as is predicted by theory. Consequently, the free-rider problem is not as devastating as predicted by economic theories.

A series of field studies showed that people not only contribute to public goods in laboratory settings but also make contributions in the real world (Rose et al., 2002; Landry et al., 2006).

Despite the hope provided by laboratory and field studies, the problem of suboptimality in voluntary contributions remains (Isaac et al., 1984, 1985). So researchers have turned from whether people contribute under a voluntary contribution mechanism to what effect contribution under a voluntary mechanism have?

This research uses laboratory experiments to study the effect of contextual factors in a game involving a voluntary contribution mechanism (VCM) in an effort to identify solutions to externality problems. The effect of framing is examined extensively.

Chapter 2

LITERATURE REVIEW

This chapter reviews previous studies about public good games. It especially focuses on the effect of different factors in VCM games. Former work has shown that human behavior is not motivated solely by narrow self-interest and that people do accept cost when engaging in pro-social activities like voluntarily contributing money or time to public goods and enforcing social norms. In this process, the institutional environment often has an important effect on pro-social behavior. Such environmental factors can affect both individuals and interactions between individuals (Meier, 2006).

Section 2.1 generally surveys former studies of influential factors in VCM games. Since I intend to study the effect of communication and status quo, sections 2.2 and 2.3 discuss these two factors in detail. Section 2.4 includes a summary of former research regarding the framing effect, providing some theoretical basis to further compare the results from the current experiments involving an externality cost with results from previous studies.

2.1   Influential Factors in VCM Games

It is clear that people's contributions in a VCM game cannot be ascribed to pure confusion. Studies have shown that, on average, about half of all cooperation in the game comes from subjects who understand free-riding but choose to cooperate out of some form of kindness or altruism (Andreoni, 1995). Thus, it is important to know which factors lead people to make contributions and how those factors affect people's decisions.

Among all of the factors that may affect subjects' decisions in a VCM game, group size and the marginal per-capital return (MPCR) are two important ones. According to Isaac and Walker (1988), increasing the group size, which reduces the MPCR, can lead to a less efficient allocation. However, their results do not support a pure numbers-in-the-group effect. Isaac and Walker further investigated the effect of MPCR by offering subjects within each group an individual MPCR and found continued strong effect from an individual's MPCR as an explanation for the level of contributions to the group good (Fisher et al., 1995). Even in heterogeneous groups, low-MPCR types contributed less than high-MPCR types. However, no "poisoning of the well" or "seeding" effect was found. Anderson et al. (1998) employed both linear and quadratic games in their theoretical models and found that contributions increase with the marginal value of the public good, total contributions increase with the number of participants, and mean contributions lie between the Nash prediction and half the endowment.

Besides group size and MPCR, there is a set of other factors that may affect decisions in a public-good game. Bagnoli and McKee (1991) designed a mechanism for voluntary provision of a public good in which the public good was provided if total contributions met or exceeded a threshold. All contributions were returned if the public good was not provided and all information was publicly known. Their design yielded Pareto-efficient outcomes, suggesting that economic agents adopt strategies that form equilibria that satisfy certain refinements to the Nash equilibrium. Messer et al. (2008) also showed that a mechanism with a provision threshold can increase the efficiency of the VCM.

Punishment also significantly influences subjects' decisions in a public-good game. Anderson and Stafford (2003) reported an experiment with a financial penalty for free-riding. They introduced the punishment mechanism in both a one-time and a

repeated treatment and found that contributing to the public good is increasing in expected punishment cost in both treatments. They also found that the punishment's severity has a larger effect on behavior than its probability. In the repeated treatment, however, past punishment had a negative rather than positive effect on contributions.

Noussair and Tucker (2007) conducted an experiment to explore whether contributions to a public good increase when public observation of contribution decisions is possible and whether any such increase is durable and transferable. They found that public observation can increase contributions to a public good in a one-shot game but that the observation can decrease contributions in a repeated game.

Reciprocity in VCM games is believed to have a significant effect on contribution decisions. Experiments show that participants in VCM games tend to match the contributions of others (Croson, Fatas and Neugebauer, 2005).

This research focuses on two factors in a VCM that includes an externality problem. One is communication, which has been extensively discussed in previous studies. The other is status quo—how the initial endowment is allocated. It is believed that status quo has a significant influence on economic activities so it has received much attention in both economics and other fields such as psychology. However, little has been done in the area of experimental economics, especially with public-good games. The study also examines the influence of the framing effect in a standard VCM game.

2.2   Communication and Voting in Pubic-Good Games

Isaac and Walker (1988a) introduced active communication into public-good games. They conducted 31 experiments with undergraduate students in lower-level economics courses. To study the effect of communication, they grouped the experiments

into three categories. When the experimenter intended to initiate communication between participants, he read the following instruction:

"Sometimes, in previous experiments, participants have found it useful, when the opportunity arose, to communicate with one another. We are going to allow you this opportunity between periods. There will still be some restrictions.

1) *You may not discuss any quantitative aspects of the private information on your screen.*

2) *You are not allowed to discuss side payments or physical threats.*

…………..

Remember, after you have returned to your terminals and the next period has begun, there will be no more communication until the next period. We allow a maximum of four minutes in any discussion session, but you may unanimously agree to return to your terminals earlier than that." (page 590)

So communication was allowed between periods (communication treatment) once the announcement was made, which occurred at various times in the experiments—ten periods of no communication (NC) followed by ten periods of communication (C), ten periods of C followed by ten periods of NC, and ten periods of NC followed by ten periods of NC as control groups. The first ten experiments (category 1) were conducted with a group size of four and the endowment was equally distributed among participants. The return of the private good was $0.01 while the marginal return for the public good was $0.003, so a MPCR of 0.33 (0.003/0.01) was employed. Several observations were obtained from the experiments. "

1) *Communication reduces free-riding even when the opportunity of communication follows substantial free-riding in a noncommunication environment.*

2)   *Observation 1 is not due to a sequencing effect. That is, without communication second-sequence observations do not lead to higher contribution levels. Indeed, in the baseline experiments (NC/NC), in twenty-six of thirty cases the second of the paired observations yielded lower total group contributions than the first.*

3)   *The ameliorative effects of communication when it follows noncommunication are hampered relative to the case in which communication is present from the beginning." (page 594)*

In categories 2 and 3, Isaac and Walker studied the cross-effect between communication and an asymmetric distribution of the endowment, the group size, and a changing MPCR. A more general conclusion was that, under all of these circumstances, face-to-face communication between periods can significantly increase people's contributions to the public good. Many other experiments were conducted to examine the impact of communication in a VCM or common pool resource game. Ostrom, Gardner, and Walker (1994) provide a thorough review.

Later works (Hackett, Schlager and Walker, 1994; Bochet, Page and Putterman, 2006) studied the impact of communication on cooperation in more complicated environments. Bochet et al. (2006) compared three forms of communication as incentives to increase contributions to public goods in laboratory experiments. They found that verbal communication through a chat room that preserves anonymity and excludes facial expressions and other visual cues was almost as efficient in increasing contributions as face-to-face communication proved to be in earlier work. Numerical communication via computer terminals, however, had no net effect on contributions or efficiency.

Brosing et al. (2003) suggested that the success of coordination efforts largely depends on the communication method. A unidirectional communication technology proved to be rather ineffective at enhancing cooperation even in small groups. Video-conferencing that was completed via a computer network was as effective as a face-to-face meeting. Audio communication only did much worse than the video-conference. Therefore, a "face-to-face" feature is important in the communication process. Bochet et al. (2006), however, argued that facial expression was not crucial. Both studies were conducted using standard public-good games so further investigation is needed to confirm the role of identification in communication.

Although some of previous studies show that voting could affect contributions in a VCM game (Kroll et al., 2007; Walker et al. 2000), some other studies showed that voting by itself does not have significant effect in a VCM game (Messer et al, 2005; Messer et al, 2007). However, when combined with cheap talk, voting may help to increase contribution in a VCM game.

Voting sometimes can also help to establish certain institutions or social norms. Zarghamee et al. (2010) created a "self-selected status quo" of giving through automatic donation. They believe this kind of social norm can be established through discussion and voting in the real world.

We would focus on the combined effect of cheap talk and voting in our experiments to test whether it persists under a negative framing.

2.3   Status Quo Effect in VCM Games

The second factor investigated here is status quo. Status quo has a significant impact on people's economic decisions. Studies in economics, psychology, and sociology show that individuals disproportionately stick with the status quo (Samuelson and

Zeckhauser, 1988). Samuelson and Zeckhauser drew this conclusion from classroom experiments that asked undergraduates to make certain choices. In the neutral environment, participants were asked to choose one option out of four (two or three in some treatments). In the status quo environment, participants were given a certain option and they had to decide whether to switch to another option. Moreover, the authors analyzed data on selections of health plans and retirement programs by faculty members from Harvard University and found that there was substantial status quo bias in important real decisions.

Kahneman et al. (1991) ascribed status quo bias to an implication of loss aversion—that is, individuals have a strong desire to remain at the status quo because the disadvantages of leaving it loom larger than the advantages. Many other real world examples of status quo bias are given in the paper. In consumer theory, status quo bias can also bias consumer decisions. This is demonstrated by analysis of their willingness to pay for a particular unpriced product (Hartman, Doane and Woo, 1991).

To further distinguish status quo bias caused by aversion to adverse outcomes from status quo bias caused by omission, Ritov and Baron (1992) conducted a series of experiments and found that subjects reacted more strongly to adverse outcomes caused by actions than those caused by inaction regardless of whether the status quo was maintained and even when inaction was associated with change.

The impact of status quo in VCM games was examined by Messer et al. (2007) and was found to have a significant effect on participants' decisions. Status quo can increase the contribution rate in a positively framed VCM game.

2.4   Framing Effect in VCM Games

The last attribute studied is the framing effect. Andreoni (1995) was the first to formally discuss framing in an experimental economics environment and his definition was used in this study. Andreoni conducted standard VCM games with 40 undergraduate students divided into groups of five. Under both positive and negative framing, participants were asked to allocate their initial endowments between an individual exchange and a group exchange. Under positive framing, the two exchanges were described as follows.

"......

The Individual Exchange: Every token you invest in the Individual Exchange will yield you a return of one. The other members of your group are not affected by your investment in the Individual Exchange.

The Group Exchange: Your return from the Group Exchange will depend on the total number of tokens that you and the other four members of your group invest in the Group Exchange. The more the group invests in the Group Exchange, the greater the return to each member of the group. Every token invested in the Group Exchange yields a return of 1/2 for each member of the group, not just the person who invested it.

......" (page 18-19)

Under negative framing, the two exchanges were described as follows.

".......

The Individual Exchange: Every token you invest in the Individual Exchange will yield you a return of one. However, each token you invest in the individual exchange will reduce the earnings of the other players by one half cent each.

The Group Exchange: Every token you invest in the Group Exchange yields a return of 1/2 for you. The other members of your group are not affected by your investment in the Group Exchange.

……" (page 17)

The results from Andreoni's experiments indicated the existence of a significant framing effect in VCM games. Participants tended to contribute more under positive framing than under negative framing. Some follow-up studies were conducted to explain the difference. Park (2000) replicated Andreoni's experiment at University of Missouri and ascribed the difference in contribution to different value orientations.[3]

The framing effect also impacts participants' decisions when the game has an interior solution (Willinger and Ziegelmeyer, 1999). Cookson (2000) found that participants contributed more when the pay-off function was decomposed in terms of a gift that was multiplied and distributed to the other players rather than as an equivalent public good from which everyone benefits. In addition, participants contributed more after they completed a comprehension task that asked them to calculate the benefits to the group of various actions rather than the benefits to themselves.

Framing was also found to have a significant effect on provision point mechanism games. Experiments by Iturbe-Ormaetxe et al. (2006, 2008) suggest that subject behavior is highly sensitive to frames and that theoretical predictions from prospect theory are confirmed except when the threshold is low.

Brandts and Schwieren (2007) studied Andreoni's negative frame but used different parameters (group size, MPCR) in their experiments. They also studied two more naturalistic frames involving stories. Their results demonstrated that frame

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[3] Social psychologists developed the concept of value orientation to explain people's behavior when they make decisions that can affect others. In Park's paper (2000), five value orientations were used, including competitive, individualistic, cooperative, altruistic, and aggressive. Participants were categorized according to a survey in the experiment.

manipulation had no significant effect on average behavior but did have some effect on extreme behavior.

Hsu (2003) also found that framing alone had no significant effect on cooperation but determined that its interaction with group size was significant. Subjects in small groups preferred "giving" to "not taking" and preferred "taking all" to "giving nothing" while subjects in large groups preferred just the opposite. Kotani et al. (2008) found that the effect of framing was negligible.

Not only studies in a laboratory setting have shown that framing effect is undecided in a public-good game, field experiments results are also controversial. Meier (2005) showed that this effect is quite limited in field experiments run at the University of Zurich. Butler and Marechal (2005), on the other hand, showed that framing does matter in political decisions. Their conclusion was based on the approval rate of two virtually identical retirement initiatives in Switzerland.

Chapter 3

EXPERIMENT

This chapter presents a discussion of the theoretical framework of this study, the experiment design, and how the experiment was conducted. A brief description of the recruitment process and subject pool are included in section 3.1. Based on previous studies of public-good games, section 3.2 discusses the public-good experiment used in this study in detail. The last section describes how the experiment was conducted and how contextual factors were implemented in different treatments.

3.1   Recruitment

All experiments were conducted at the Experimental Economics Laboratory for Policy and Behavioral Research at University of Delaware. Subjects were mainly recruited by e-mail. All participants were undergraduate students with some economic background.[4] They were asked to sign up for an economic experiment named "Decision Research" in an online system before they showed up at the laboratory.

3.2   Experiment Design

The experiments in this study were based on prior work and were designed to test the effects of three factors—cheap talk, voting, and the status quo of the initial endowment—plus the cross-effects between them. Six treatments were employed. Since

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[4] The potential subject pool mainly included all undergraduate students from the School of Business and undergraduate students majoring in agricultural economics, political science, and marine policy.

previous research had examined such factors under positive framing, the current results could be compared with those of previous studies to analyze the framing effect.

After initial pilot sessions of experiment protocols, six sessions were conducted for each treatment. Each session involved twenty rounds with seven subjects. Subjects were not allowed to participate in more than one session. Generally, participants' earnings were between $10 and $15. The time required for each session varied according to the treatment (generally, 20 minutes to half an hour for treatments without cheap talk and 40 minutes to an hour for treatments with cheap talk). Experiments were run either with a single group or with two groups together. For the sessions with two groups, each group received the same treatment and communication among group members was completed separately by having one group talk in the laboratory and the other in the hallway.

Subjects received written instructions[5] and the experimenter gave a verbal description of the experiment using a Microsoft PowerPoint presentation to explain the instructions with numerical examples. Subjects were told that they had to make a decision in every round and would receive certain information after all participants had submitted their decisions. The number of rounds, however, was mentioned only as "a certain number of rounds until we terminate the experiment." Thus, theoretically, subjects were not aware of the number of rounds until the end of the session.

At the start of each round, subjects were endowed with one dollar each and had to decide how to allocate that dollar between two accounts named Account A and Account B. The money they put in Account A would be multiplied by 3/2 (1.5) and the new amount would be theirs to keep at the end of the round. The money they put in Account B would be multiplied by 5/2 (2.5) and the new amount would be theirs to keep

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[5] The various versions of the full instructions can be found in the appendix.

at the end of the round. To introduce a negative externality into the game, all subjects were required to pay an equal "Account B Loss" that was calculated by summing the Account B contributions of all of the group members and multiplying that amount by 3/14 (0.214) which was also the MPCR of the game. Therefore, a subject's earnings in a round were **his** Account A payoff plus **his** Account B payoff minus the Account B Loss, which was the same amount for each member. A table in the instructions showed how the Account B loss was calculated at different levels of the total amount in Account B.

To test the effect of status quo bias, subjects in half of the treatments (treatments 1, 3, and 5) started each round with an initial balance of one dollar in Account B (the account with negative externality) and had to decide whether to **make a contribution** by moving part or all of their money from Account B to Account A (the account without a negative externality). Any money not contributed to Account A would be put into the subject's Account B. Subjects in the other half of the treatments (treatments 2, 4, and 6) started each round with an initial balance of one dollar in Account A. The subjects had to decide whether to **request a refund** by moving part or all of that dollar from Account A to Account B. Any money not refunded would be kept in the subject's Account A. In treatments 1 and 2, no communication was allowed between subjects. In treatments 3–6, subjects had the opportunity to talk with their group members.

Therefore, the effects of communication (both with and without voting) and status quo bias on contributions were tested in a public-good game. According to Andreoni's (1995) definition, all of the experiments were conducted with negative framing. Consequently, the results could be compared with a former study in which these experiments were run under positive framing (Messer et al., 2007) to examine the framing effect. Table 3.1 gives a description of all of the treatments employed in our experiment.

Table 3.1. Brief description of all sessions.

	Cheap Talk	Vote	Status quo	No. of Subjects
Treatment 1	No	No	Externality	42
Treatment 2	No	No	Social optimal	42
Treatment 3	Yes	No	Externality	42
Treatment 4	Yes	No	Social optimal	42
Treatment 5	Yes	Yes	Externality	42
Treatment 6	Yes	Yes	Social optimal	42

3.3   Experiment Procedure

All subjects were randomly assigned to a computer terminal by drawing a bingo ball. Subjects made their decisions using a Microsoft Excel spreadsheet that was programmed with Visual Basic for Applications. The data were stored in a Microsoft Access database. In each round, subjects submitted their decisions confidentially and the experimenter guided them to update the information (Account B loss and total amount in Account B) for the current round and proceed to the next round. Subjects could review information from previous rounds and track cumulative earnings throughout the experiment. They were paid in U.S. dollars at the end of each session with an exchange rate of 1:2 (1 U.S. dollar = 2 Experimental dollars).

Subjects in treatments 1 and 2 were told who their group members were and that they were not allowed to talk during the entire process of the experiment. Subjects in Treatment 3 (cheap talk) and 4 were told who their group members were and were given up to ten minutes to talk about their strategies for the game. The talk was open and free in the group before the first round of the session. After the experimenter terminated the discussion, subjects were not allowed to communicate in any form. Binding deals and threats were not permitted. There was one administrator with each group in the discussion in case they had any questions regarding the instructions or the experiment itself. Subjects were also told that decisions made by other groups would not affect their earnings and no communication was made between groups. This helped to elucidate the effect of initial cheap talk on contributions.

Elaborating on treatments 3 and 4, voting was added to generate treatments 5 and 6. Although voting by itself does not appear to cooperation (Kroll et al., 2007, Messer et al, 2007), it might still have an effect when used together with other contextual factors. In these two treatments, subjects were informed of their group members and had

the opportunity to have a discussion with them. The only difference was that they were also told that they could choose to play one game out of two and that the group needed to vote after the discussion to decide this. The group voted on two options called "Group Activity" and "Private Lottery." If a majority of the group voted to play "Group Activity," the group participated in the VCM game. If the majority of the group voted to play "Private Lottery," then in each round the subject received one dollar and individually decided whether to purchase a private lottery ticket costing one dollar. The pay-off of the lottery ticket depended on the result of a toss of a fair coin with "heads" resulting in a pay-off of two dollars and "tails" resulting in no pay-off. Subjects who did not purchase a lottery ticket retained the dollar.[6] After all votes were cast, the results were announced and the game favored by the majority was played. Cheap talk was carried out before voting, which gave group members an opportunity to talk about their voting intentions. The intentions can be considered as a signal for cooperation and this study examined whether voting enhanced cooperative behavior in the public-good game.

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[6] No group in the experiments had a majority of participants voting in favor of playing the lottery game. Detailed voting result is included in the next chapter.

Chapter 4

EXPERIMENT RESULTS

Results from the experiment were analyzed at group and individual levels. At the group level, this section reports the effects of different treatments on contributions. A Tobit model was employed to analyze the data and that analysis is presented in section 4.1. For the individual level, attention was focused mainly on the "extreme behaviors" (zero contributions and full contributions). A Probit model was used to analyze the effects of treatments on the probability that subjects would make zero or full contributions.

Table 4.1 lists the contributions made (as a percentage) to the public account under negative framing. A Wilcoxon rank-sum test was performed to determine whether the effect of a treatment was different from that of other treatments. This test is a non-parametric statistical hypothesis test for the case of two related samples or repeated measurements on a single sample.

Initial contributions as a fraction of the endowment in the first round ranged from a low of 39.5% for Treatment 1 (baseline) to a high of 98.3% for Treatment 5 (cheap talk and voting). In round 10, the contribution rates ranged from a low of 14.7% in Treatment 2 (status quo) to a high of 93.2% in Treatment 5 (cheap talk and voting). The contribution rates in the final round 20 ranged from a low of 11.7% in Treatment 2 (status quo) to a high of 88.5% in Treatment 5 (cheap talk and voting). These results demonstrate that context plays an important role in initial contributions under negative framing. The information in Table 4.1 demonstrates that cheap talk can significantly

increase the contribution rate in both early and later rounds in a negatively framed experiment. Voting also has an effect on contributions but the effect varies with different status quo settings. When the status quo is social optimal, voting tends to decrease contribution rates but the effect is not statistically significant even at the 0.1 level. With a status quo of negative externality, voting can increase contribution rates and the effect is statistically significant at the 0.01 level.

Status quo also influences the rate of decay. Treatments 2, 4, and 6 (treatments with a status quo of social optimal) show a statistically significant decrease in contributions between rounds 1 and 10 at the 0.01 level. For treatments 1, 3, and 5 (treatments without a status quo of socially optimal), however, the differences are not statistically significant at the 0.05 level. Thus, a status quo of social optimal can lead to a quicker decay although it might induce a slightly higher contribution at the beginning.

Table 4.1. Contributions to a public account. Two sample Wilcoxon rank-sum (Mann Whitney) tests.

	1st round contribution	10th round contribution	20th round contribution
Treatment 1	0.395 [3,4,5,6]	0.173 [3,4,5,6]	0.117 [3,4,5]
Treatment 2	0.452 [3,4,5,6]	0.147 [3,4,5,6]	0.147 [3,4,5]
Treatment 3	0.815 [1,2,5]	0.773 [1,2,4,5,6]	0.643 [1,2,4]
Treatment 4	0.767 [1,2,5]	0.581 [1,2,3,5]	0.417 [1,2,,3,5]
Treatment 5	0.983 [1,2,3,4,6]	0.932 [1,2,3,4,6]	0.885 [1,2,3,4,6]
Treatment 6	0.752 [1,2,5]	0.420 [1,2,3,5]	0.295 [3,5]

Wilcoxon rank-sum test was applied. Combined sample size of each test is 84.

Note: [1] denotes different from treatment 1 at 0.05 level.

[2] denotes different from treatment 2 (status quo) at 0.05 level.

[3] denotes different from treatment 3 (cheap talk) at 0.05 level.

[4] denotes different from treatment 4 (cheap talk, status quo) at 0.05 level.

[5] denotes different from treatment 5 (cheap talk, voting) at 0.05 level.

[6] denotes different from treatment 6 (cheap talk, voting, status quo) at 0.05 level.

4.1   Group-Level Analysis

Figures 4.1a–4.1c show round-by-round average contributions for each treatment and stand for the social efficiency level. The figures contrast the treatments with no status quo with treatments in which the status quo is social optimal. Figure 4.1 shows results without cheap talk or voting. Figure 4.2 adds cheap talk and Figure 4.3 adds voting.

Negatively Framed VCM Game
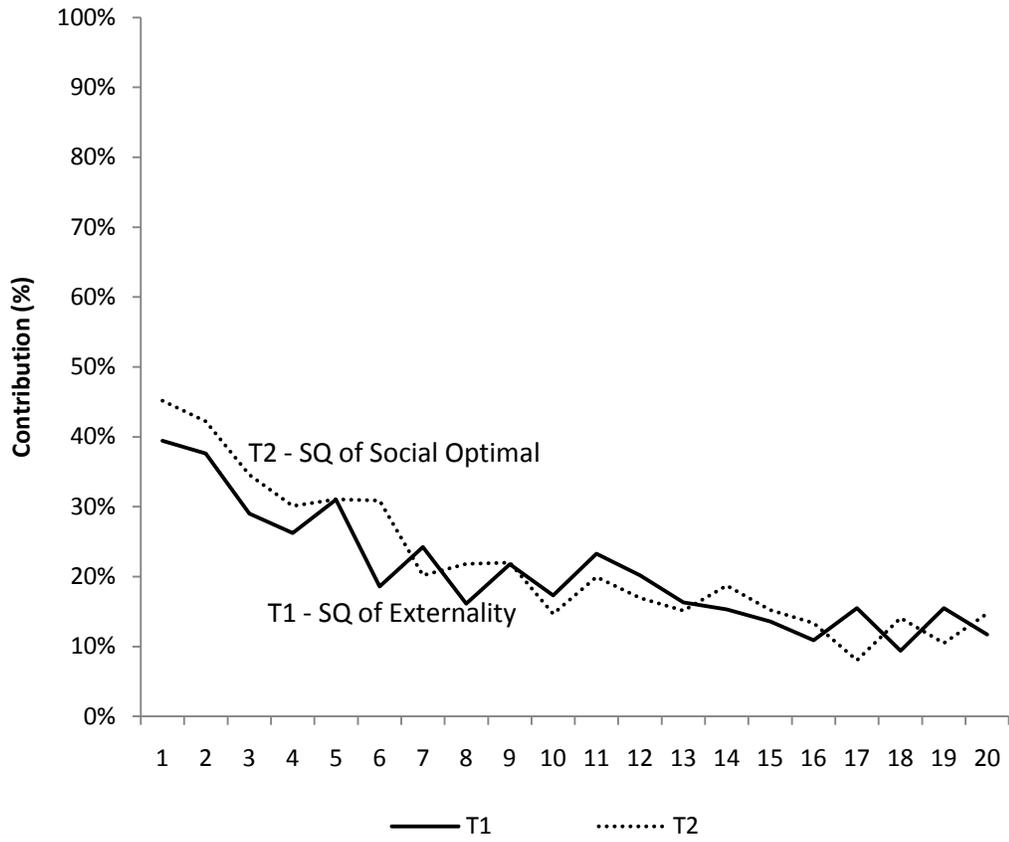
Figure 4.1 a. Contributions in treatments 1 and 2

Negatively Framed VCM game with Cheap Talk
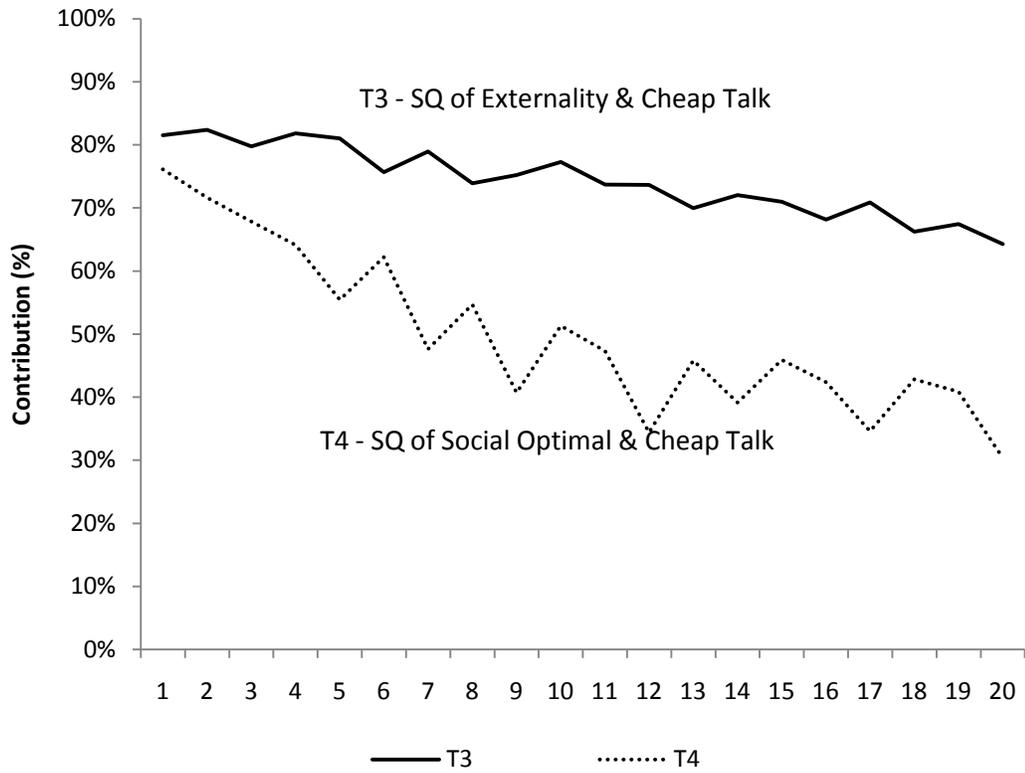
Figure 4.1b. Contribution rates in treatments 3 and 4

Negatively Framed VCM game with Cheap Talk and Voting

T5 - SQ of Externality, Cheap Talk & Vote

T6 - SQ of Social Optimal, Cheap Talk & Vote

——— T5   ·········· T6
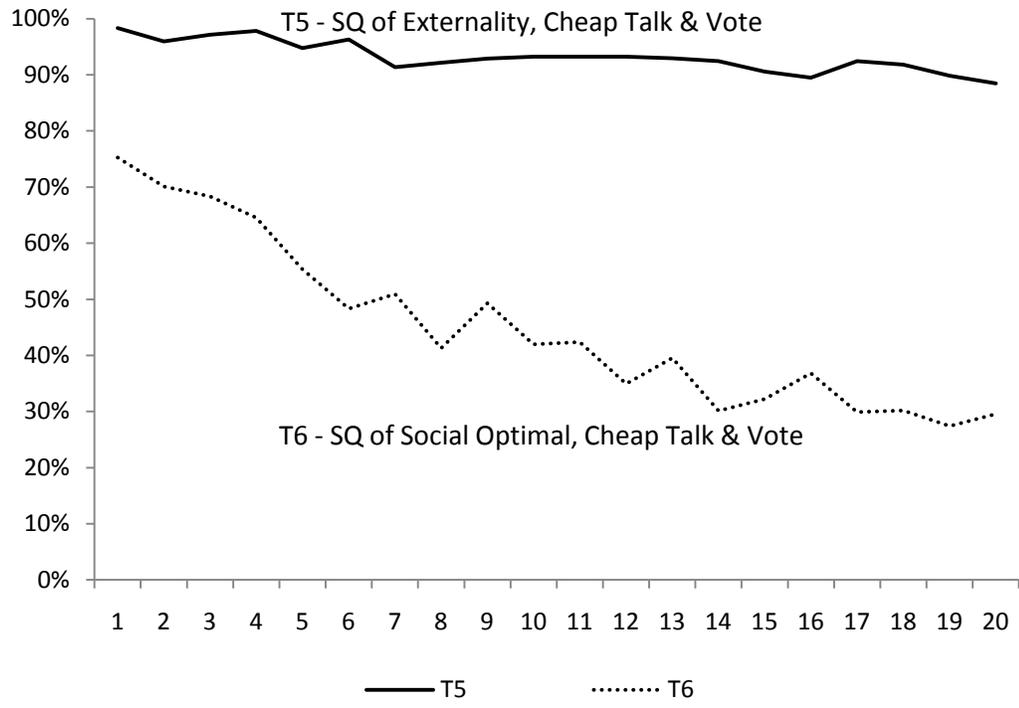
Figure 4.1c. Contribution rates in treatments 5 and 6

When looking at figure 4.1a, status quo affected the contribution rate only in the first five rounds. A status quo of social optimal tends to increase contributions but the effect diminishes immediately after several rounds. This pattern is different from a former study that used positive framing (Messer et al., 2007). Consequently, a conclusion can be drawn that status quo by itself does not have a continuous effect on contributions in a pure public-good game. Upon adding cheap talk to the experiment, the effect of status quo disappears even in the first several rounds, although the faster decay with status quo of social optimal remains. This leads the social optimal treatment to lower contribution rates in later rounds compared to the negative externality treatment. Furthermore, when voting was added to the experiment, the treatment without status quo of social optimal fostered greater contributions even in the first round.

Thus, from Figure 4.1a–4.1c, we can derive the following observations:

1) Under negative framing, the effect of status quo on contributions is not obvious;

2) Communication has a positive effect on contributions as demonstrated in previous works;

3) Voting by itself does not have a significant effect on contributions but it may affect the contribution rate by magnifying the effect of status quo;

4) With a status quo of social optimal, contributions are more likely to decay quickly.

To further quantify the effects of contextual factors in the experiment and to test the hypotheses, two-limit Tobit regressions were employed to test the significance of all

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treatments in the experiment since simple ordinary least squares (OLS) regression can lead to inconsistent estimations. Regressions were run in Stata 11 to capture the characteristics of group behavior.

Previous studies of public-good games have indicated that participants in a public-good game can be grouped into categories (Burlando and Guala, 2004), presenting the possibility of a heterogeneous agent problem. To account for this problem, I used an Tobit model with random effects instead of a Tobit model in Stata for the analysis. Results from the regressions are shown in Table 4.2.

Table 4.2. Effect of treatments and rounds on contributions (group level). Analyzed with Tobit model with random effects. Dependent variable: contribution to public account.

Variable	Coefficient	Standard Error	P-value
Intercept	0.3379**	0.0404	0.000
TR2 (SQ)	0.0475	0.0572	0.412
TR3 (CT)	0.6203**	0.1663	0.001
TR4 (SQ/CT)	0.4923*	0.1851	0.012
TR5 (CT/VT)	0.9510**	0.2381	0.000
TR6 (SQ/CT/VT)	0.4791*	0.2199	0.036
TR1×Round	-0.0125**	0.0018	0.000
TR2×Round	-0.0158**	0.0017	0.000
TR3×Round	-0.0120	0.0073	0.109
TR4×Round	-0.0187**	0.0039	0.000
TR5×Round	-0.011	0.0153	0.456
TR6×Round	-0.0286**	0.0052	0.000
Log likelihood	361.6318		
Left-censored	3		
Uncensored	544		
Right-censored	173		

Jackknife standard errors are reported. * denotes significant at 0.01 level. ** denotes significant at 0.05 level. Sample size of balanced panel is 720 with 20 in each group.

The dummy variables TR2–TR6 stand for treatments 2–6. Thus, coefficients of these variables show the effect of the treatments on contribution rates. TR1×Round–TR6×Round are round variables for each treatment. Panel data were nested by group to account for heterogeneity among groups. A total of 720 observations (6 treatments × 6 sessions × 20 rounds) were included in the regression. Three observations were left-censored (contribution = $0) and 173 observations were right-censored (contribution = $1).

The regression results in Table 4.2 are consistent with Figures 4.1–4.3 by showing the coefficients of TR2–TR6. TR2(SQ) has a coefficient of 0.0475, which means that a status quo of social optimal can increase the contribution rate by 4.75 points in percentage or 13.6%. However, this increment is not significant even at a 10% level. F-tests were also carried out to determine the difference between TR3(CT) and TR4(SQ/CT) and between TR5(CT/VT) and TR6(SQ/CT/VT). As hypothesized, these differences are not significant at the 10% level.[7] Consequently, status quo does not have a significant effect on contributions in the public-good games.

In our econometric model, we used Tobit model with random effects and panel data was nested by groups. Therefore, robust standard error or clustered standard error should be employed to account for heteroscedasticity problem and possible specification errors. Moreover, contribution rate is censored at either 0 or 1 so the normal distribution assumption of residuals could be violated. However, robust standard error is only efficient with large sample size, so using robust standard error is our model may lead to inefficiency. (Hinkley and Wang, 1991)

In order to take the heteroscedasticy problem into account and to avoid the inefficiency of robust standard error, I reported Jackknife standard error in our

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[7] With p-values of 0.5905 and 0.1221 respectively.

econometric model which uses a resample technique to estimate the standard error of the regression. Jackknife method does not require certain distribution assumption of the residuals to estimate standard error so it can help to solve the problem (Miller, 1974). In STATA 11, the package estimates Jackknife standard error by using delete-one Jackknife method. This method has been shown as an efficient way to estimate standard errors (Wu, 1986)

To test the effect of cheap talk, one must compare treatments with and without it. TR3(CT) has a coefficient of 0.6203, which is significant at a 1% level. This means that cheap talk by itself can increase the contribution rate by 62.03 points in percentage or 178.1%. The same analysis applies to TR2(SQ) and TR4(SQ/CT). An F-test shows that the coefficient of TR4(SQ/CT) is significantly larger than the coefficient of TR2(SQ) at a 5% level.[8] Thus, regardless of the status quo, cheap talk can always significantly increase the contribution rate in public-good games, a result also demonstrated by previous studies.

Finally, the effect of voting can be tested by applying an F-test to TR3(CT) and TR5(CT/VT) and to TR4(SQ/CT) and TR6(SQ/CT/VT). Results show that voting by itself does not significantly increase or decrease contributions at the group level.[9]

To identify the treatments that lead to a faster decay, round variables for all treatments were included in the regression. Round variables for TR1, TR2(SQ), TR4(SQ/CT), and TR6(SQ/CT/VT) are all significant at the 1% level while the round variables for TR3(CT) and TR5(CT/VT) are not significant at the 5% level. For Treatment 1 (baseline), on average, the contribution rate goes down by 1.25 points in percentage in each round. This number is 1.58 for Treatment 2 (status quo). Therefore,

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[8] With a p-value of 0.022.
[9] With p-values of 0.2405 and 0.9618 respectively.

the decay in each round is 0.33 points higher for Treatment 2 (status quo) than for Treatment 1 (baseline). When adding cheap talk and voting into the treatments, the gap becomes larger. For treatments 3 and 4, the difference is 0.67 while for treatments 5 and 6, the difference is 1.7. More importantly, the coefficients of the round variables of treatments 3 and 5 are not significantly different from zero so there is no significant decay in contributions in those two treatments. As a result, a socially optimal status quo combined with cheap talk and/or voting can cause contributions to decline more quickly.

4.2   Individual-Level Analysis

Regression at the group level demonstrated the effect of cheap talk and the ineffectiveness of status quo and voting in increasing voluntary contributions. Group level data, however, may not capture all of subjects' various behaviors in the experiments. Therefore, analysis at the individual level is needed. Figures 4.4a–4.4f provide frequencies of contribution rates that give a straightforward description of individual behaviors.

Contribution in Treatment 1
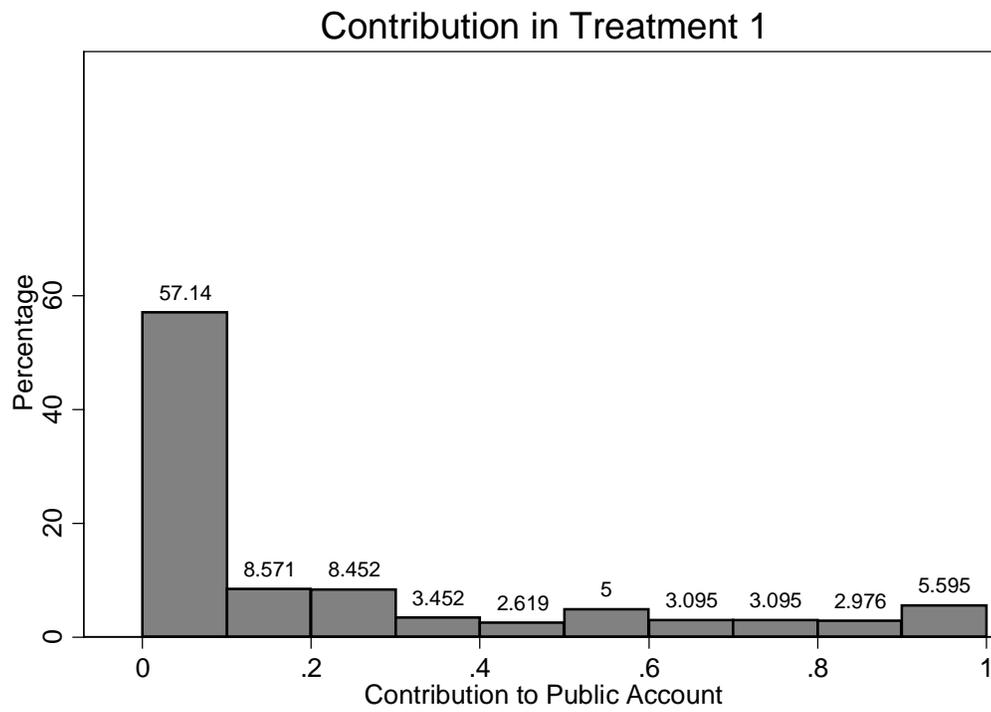
Figure 4.2a. Contribution in Treatment 1 (baseline)

Contribution in Treatment 2
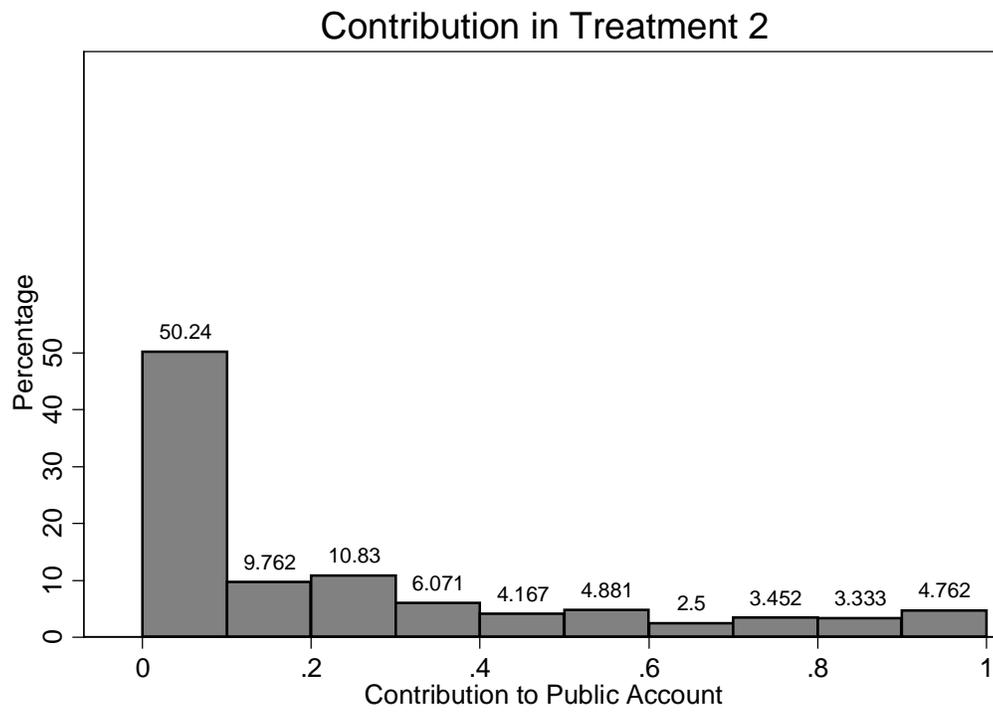
Figure 4.2b. Contribution in Treatment 2 (status quo) (status quo)

Contribution in Treatment 3
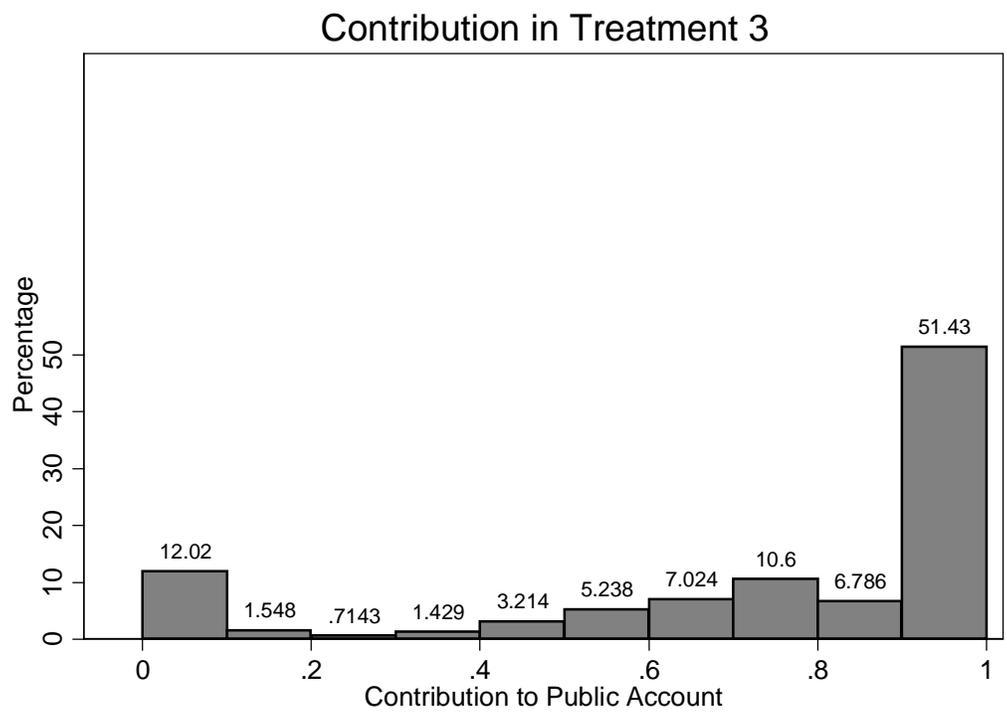
Figure 4.2c. Contribution in treatment 3 (cheap talk)

Contribution in Treatment 4
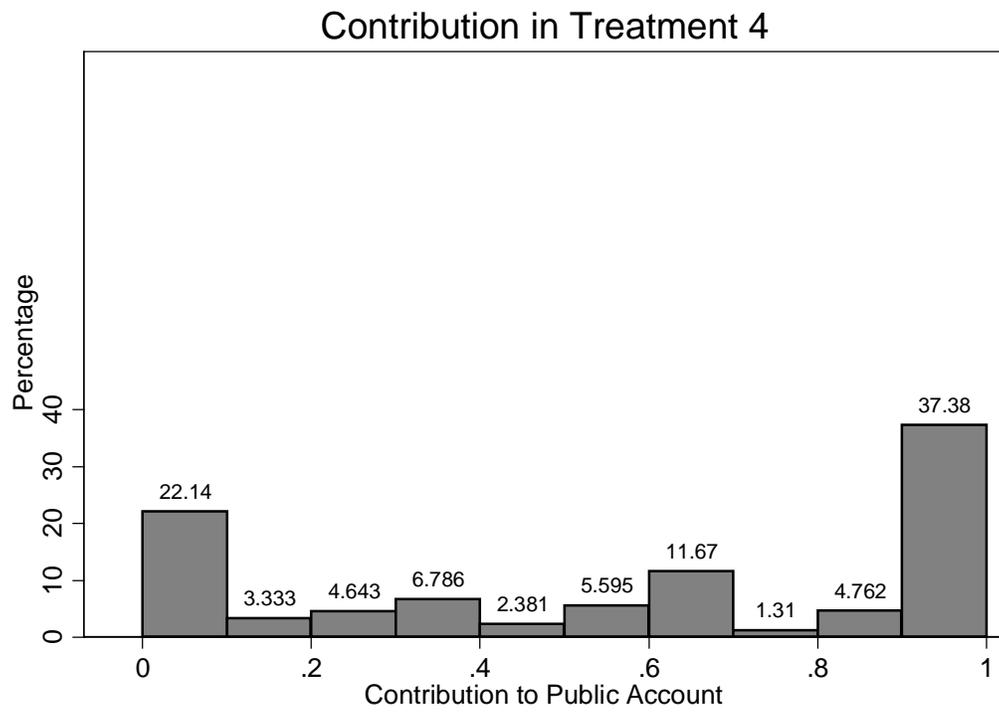

Figure 4.2d. Contribution in treatment 4 (cheap talk and status quo)
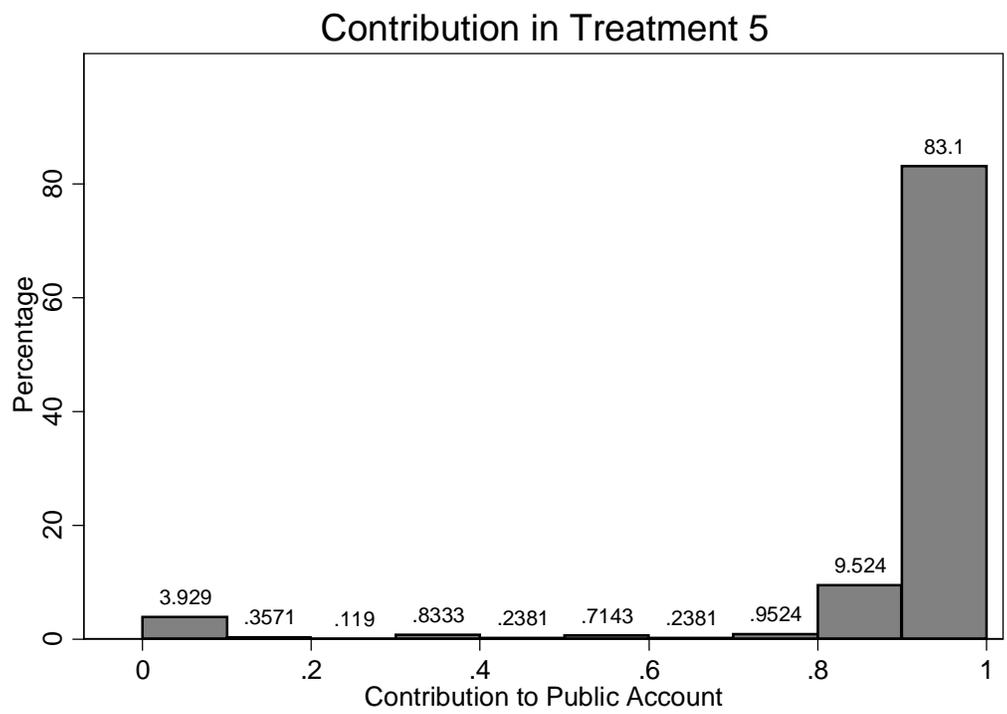
Figure 4.2e. Contribution in treatment 5 (cheap talk and voting)

Contribution in Treatment 6
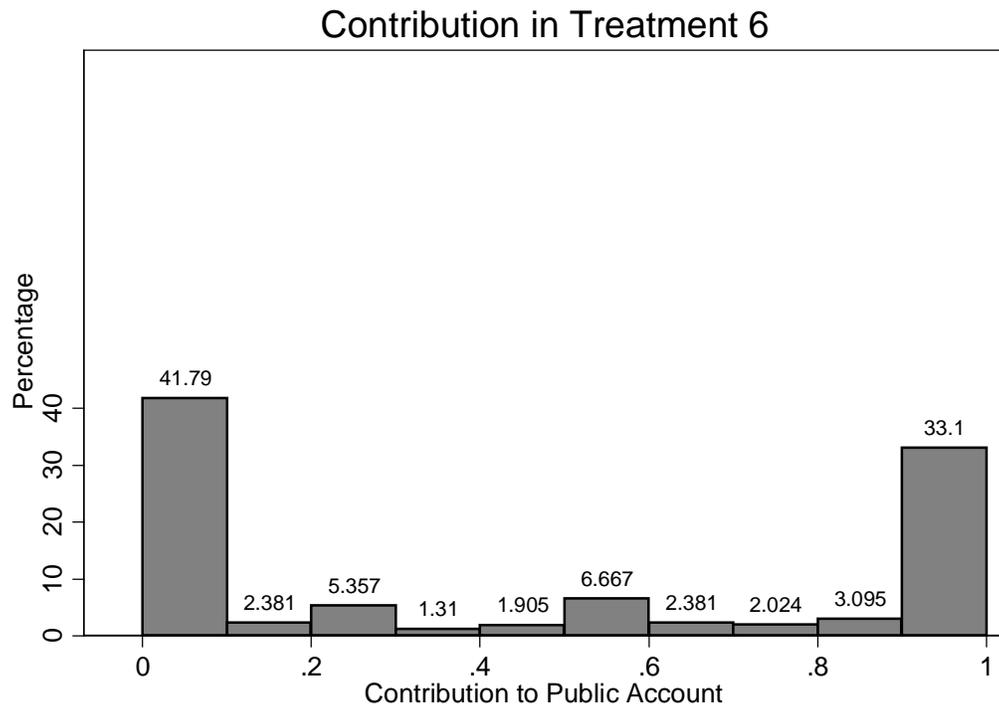
Figure 4.2f. Contribution in treatment 6 (cheap talk, voting, and status quo)

Figures 4.2a–4.2f show that extreme values of contribution are more likely to occur in public-good experiments. The two most extreme cases happened in treatments 1 and 5. In Treatment 1 (baseline), 57.14% of all observations are lower than 0.1. In Treatment 5 (cheap talk and voting), 83.1% of all observations are higher than 0.9.

Figures 4.2a–4.2f give distributions for the contributions in each treatment. To show the trend of extreme values from round 1 to round 20, the distributions are graphed in Figures 4.3a–4.3f.

Negatively Framed VCM Game
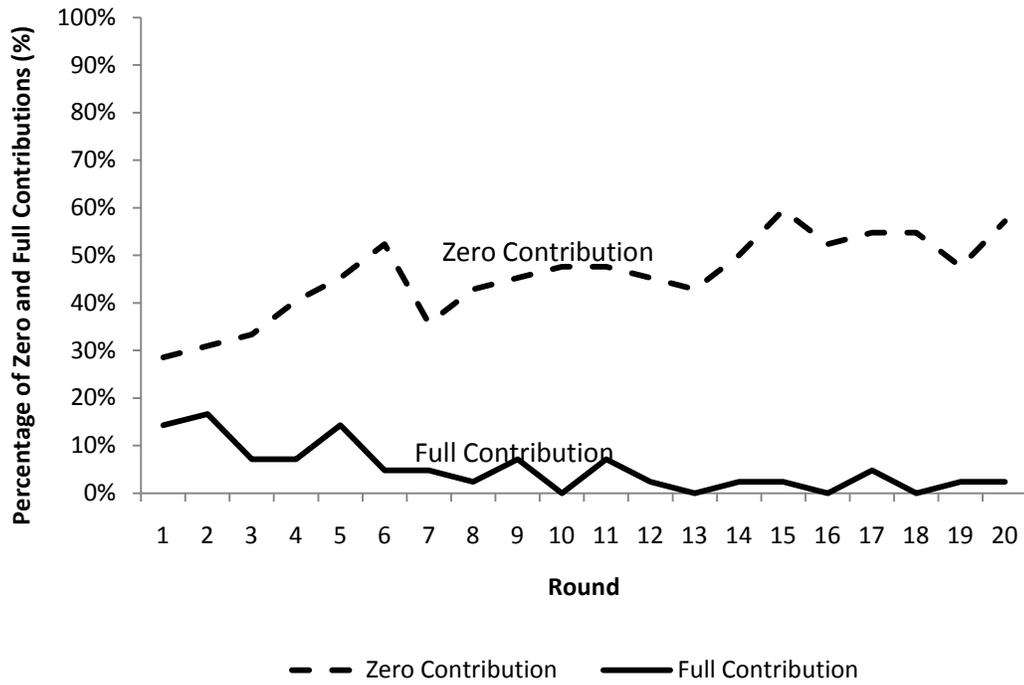
Figure 4.3a. Zero contribution and full contribution in Treatment 1 (baseline)

Negatively Framed VCM Game with Status Quo
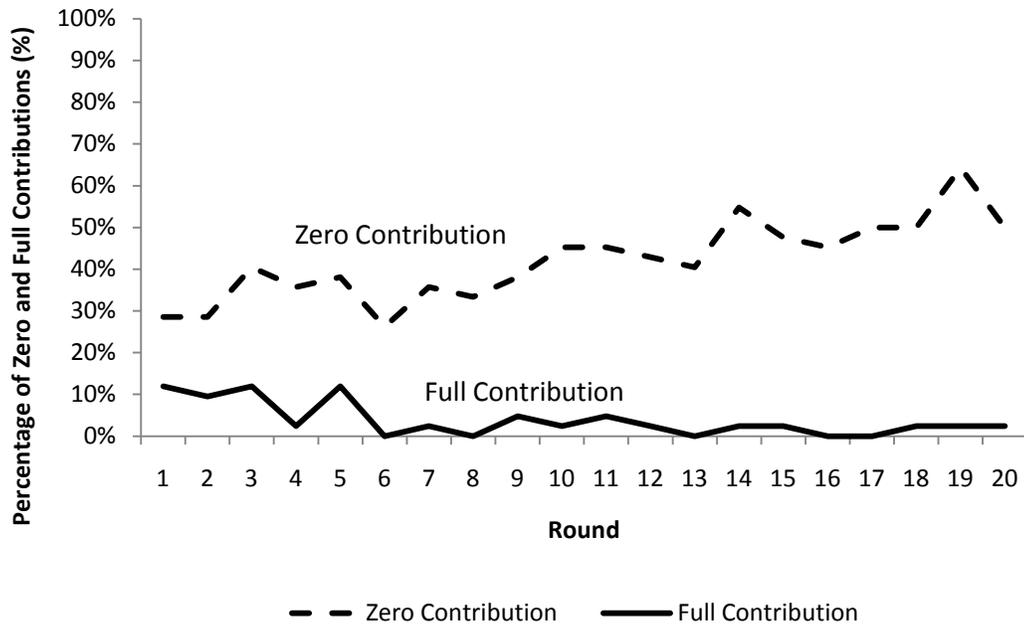
Figure 4.3b. Zero contribution and full contribution in Treatment 2 (status quo)

Negatively Framed VCM Game with Cheap Talk
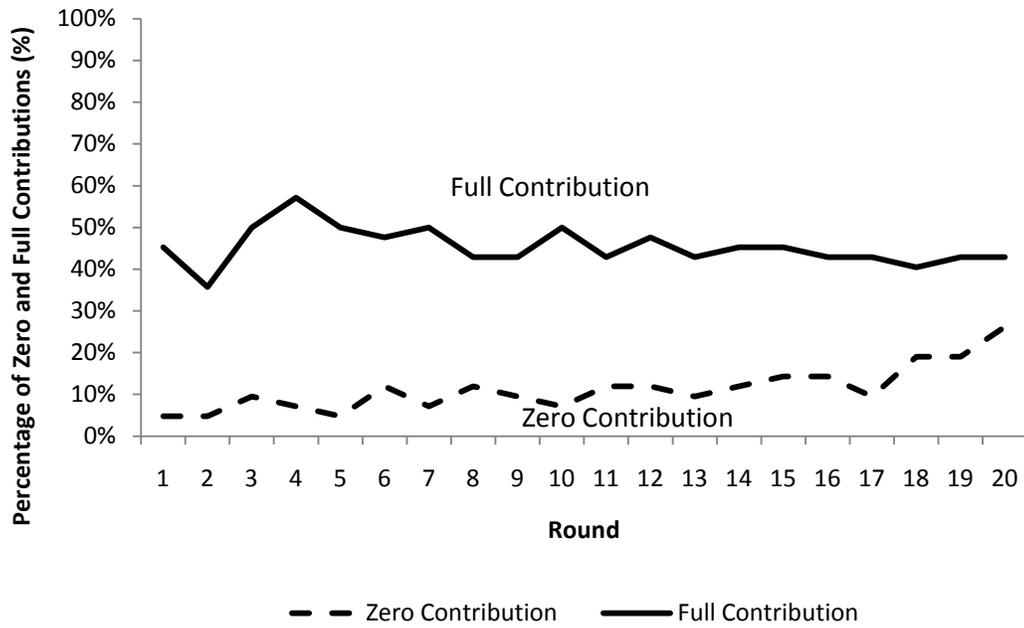
Figure 4.3c. Zero contribution and full contribution in Treatment 3 (cheap talk)

**Negatively Framed VCM Game
with Cheap Talk and Status Quo**
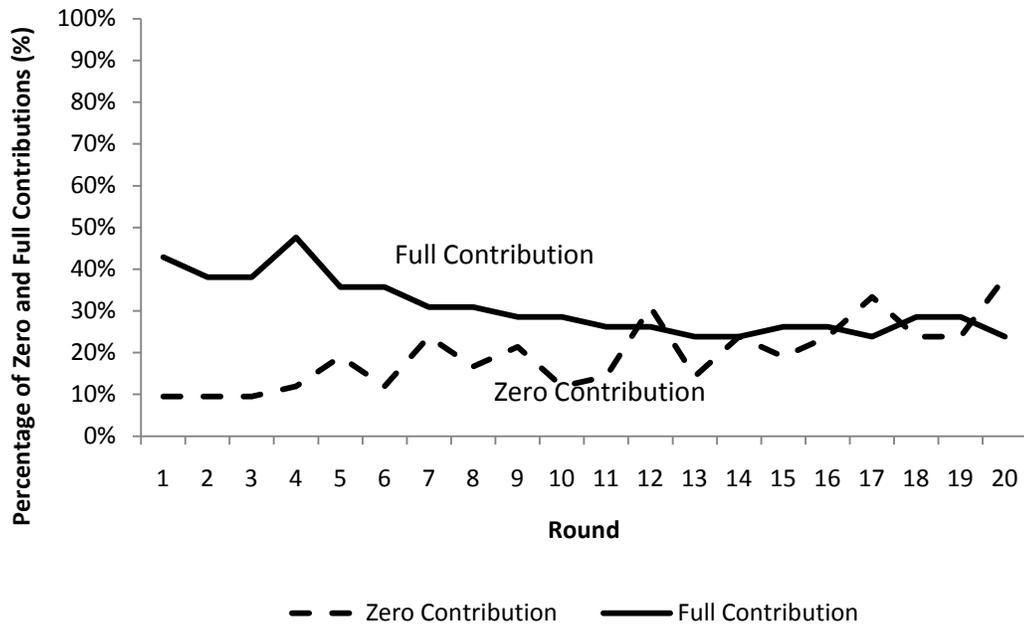
Figure 4.3d. Zero contribution and full contribution in Treatment 4 (cheap talk and status quo)
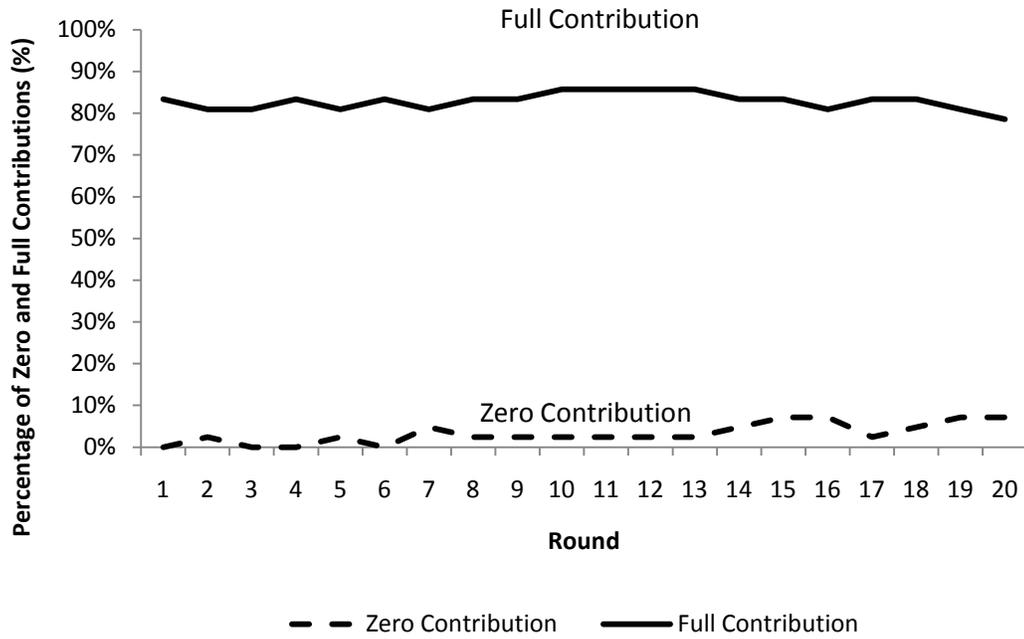
Figure 4.3e. Zero contribution and full contribution in Treatment 5 (cheap talk and voting)

**Negatively Framed VCM Game
with Cheap Talk, Voting, and Status Quo**
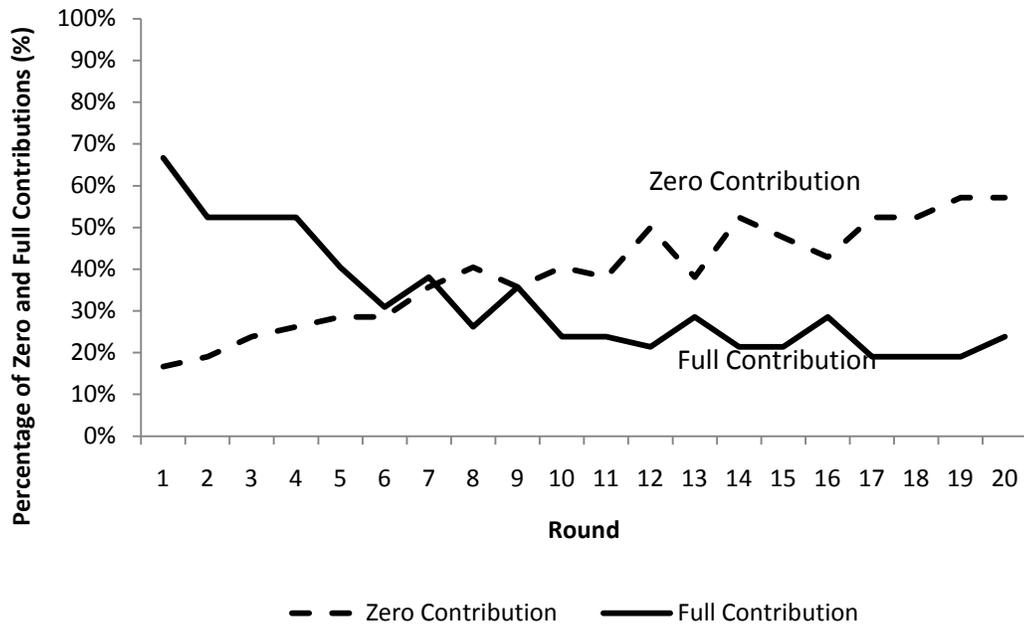
Figure 4.3f. Zero contribution and full contribution in Treatment 6 (cheap talk, voting, and status quo)

Figures 4.3a–4.3f present the trend of zero contributions and full contributions in each treatment. Several conclusions can be drawn from the figures.

1) Without context factors (cheap talk and voting), full contribution observations are always less than 20%. Zero contribution observations, however, are also always less than 70%, which means many people do contribute "something" instead of "nothing" in a public-good game.

2) Cheap talk can increase full contribution observations and decrease zero contribution observations.

3) Status quo does not have a significant effect on zero or full contributions.

4) The "best" treatment is treatment 5 (cheap talk and voting) in which full contribution observations were always more than 80% and zero contribution observations were always less than 10%.

To further study the effect of these factors, the Probit model with random effects in Stata 11 was employed to test the treatments' effects on the probability of full contributions and zero contributions. Tables 4.4 and 4.5 provide results of the Xtprobit regressions.

Table 4.3. Effect of treatments and rounds on zero contribution (individual level). Analyzed with Probit model with random effects. Dependent variable: dummy of zero contribution.

Variable	Coefficient	Standard Error	P-value
Intercept	-0.8187*	0.3207	0.011
TR2 (SQ)	-0.3353	0.4469	0.454
TR3 (CT)	-3.2506**	0.7418	0.000
TR4 (SQ/CT)	-1.5874**	0.4766	0.001
TR5 (CT/VT)	-4.1691	2.2790	0.069
TR6 (SQ/CT/VT)	-0.8765*	0.4438	0.049
TR1×Round	0.0548**	0.1368	0.000
TR2×Round	0.0629**	0.1436	0.000
TR3×Round	0.1119**	0.0354	0.002
TR4×Round	0.0660**	0.1851	0.000
TR5×Round	0.1042	0.1086	0.418
TR6×Round	0.1029**	0.1074	0.000
Log likelihood	-1561.9014		

Jackknife standard errors are reported. * denotes significance at 0.01 level. ** denotes significance at 0.05 level. Sample size of balanced panel is 5,040 with 20 in each group.

Table 4.4. Effect of treatments and rounds on full contribution (individual level). Analyzed with Probit model with random effects. Dependent variable: dummy of full contribution.

Variable	Coefficient	Standard Error	P-value
Intercept	-1.9569**	0.3791	0.000
TR2 (SQ)	-0.3956	0.4539	0.384
TR3 (CT)	2.1231**	0.6688	0.002
TR4 (SQ/CT)	1.5235*	0.6091	0.013
TR5 (CT/VT)	5.0198**	1.0238	0.000
TR6 (SQ/CT/VT)	2.6603**	0.5788	0.000
TR1×Round	-0.0770**	0.0242	0.002
TR2×Round	-0.0736**	0.0238	0.002
TR3×Round	-0.0224	0.0230	0.332
TR4×Round	-0.0729*	0.0293	0.014
TR5×Round	-0.0096	0.0382	0.802
TR6×Round	-0.1551**	0.0220	0.000
Log likelihood	-1100.0737		

Jackknife standard errors are reported. * denotes significance at 0.01 level. ** denotes significance at 0.05 level. Sample size of balanced panel is 5,040 with 20 in each group.

Table 4.2 demonstrates that people generally contribute "something" instead of "nothing" in the negative externality games. This certainly contradicts Nash equilibrium prediction regarding contributions to a public good but is consistent with previous behavioral studies. Since all of the treatment variables have negative coefficients, the context factors used in the experiments can reduce the frequency of zero contributions. Some of the treatments, however, do not have statistically significant coefficients. Because the Probit model with random effects is used, the marginal effect of the treatments and rounds cannot be calculated. Nonetheless, the potential for zero or full contributions in a specific treatment and a specific round can be determined by converting the z-values in the Probit regression to probability values.

For example, in Treatment 1 (baseline), the probability that a subject will make a zero contribution in the first round is 22.25% while it is 60.93% in the last round. Subjects are more likely to make a zero contribution in later rounds. Previous studies found that subjects' behaviors converged to predictions of Nash equilibrium over time. Although not significant at the 0.05 level, the coefficient of TR5 has a p-value of 0.069. In the first round of Treatment 5 (cheap talk and voting), the probability of a zero contribution is nearly zero; in the last round it is 1.85%. Thus, one can confidently predict that cheap talk and voting together reduce the probability of making a zero contribution significantly. In Treatment 2 (status quo), the probability of a zero contribution is 13.76% in the first round and 54.16% in the last round. Compared to no status quo (treatment 1), a status quo of social optimal slightly reduced the probability of a zero contribution but the coefficient was not statistically significant. Values for the first and last rounds are 0% and 3.35% for Treatment 3 (cheap talk), 0.96% and 13.88% for Treatment 5 (cheap talk and status quo), and 5.57% and 64.13% for Treatment 6 (cheap talk, voting and status quo).

Since all of the coefficients of the round variables are positive, round variables play a role in increasing the probability of a zero contribution. In Treatment 6 (cheap talk, voting and status quo), this effect is especially obvious. Although the combination of cheap talk, voting, and a status quo of social optimal was the best solution in a positively framed public-good game (Messer et al., 2007), it was not the best solution when a negative externality was introduced. Instead, such a treatment tends to increase the likelihood that people will donate nothing. In this study, a combination of cheap talk, voting, and no status quo of social optimal best achieved the social optimal target.

The same analysis can be applied to full contributions. In the baseline treatment (treatment 1), the probability of a full contribution in the first round is 2.01% and decreases to 0.02% by the last round. For the "best" treatment (treatment 5), the probability is 99.89% in the first round and 99.80% in the last. More importantly, the coefficient of TR5(CT/VT) is highly significant in this regression. Another noticeable feature in this regression is that the round variable does *not* always have an effect on the probability of a full contribution. The coefficients of TR3(CT) and TR5(CT/VT) are not significant even at the 0.1 level. This means that subjects in these treatments are more likely to maintain the full contribution strategy. The probabilities for full contributions in the other treatments are: Treatment 2 (status quo), 0.76% in the first round and 0.01% in the last round;[10] Treatment 3 (cheap talk), 55.72% in the first round and 38.89% in the last round; Treatment 4 (cheap talk and status quo), 30.63% in the first round versus 2.92% in the last round; and Treatment 6 (cheap talk, voting and status quo), 70.83% in the first round but only 0.82% in the last round.

Overall, a status quo of social optimal can neither reduce the probability of a zero contribution nor increase the probability of a full contribution. Instead, the

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[10] The coefficient of TR2 is not significant at the 0.05 level. It has a p-value of 0.384.

opposite was true: a status quo of social optimal led to a higher likelihood of a zero contributions and a lower likelihood of a full contribution in later rounds. This is clearly demonstrated by comparing treatments 4 and 6 with treatments 3 and 5.

Cheap talk can reduce the probability of a zero contribution as well as increase the probability of a full contribution. Voting has an inconsistent effect on both zero contributions and full contributions. It seems to enhance subjects' behavior in treatments 3 and Treatment 5 (cheap talk and voting).[11] Thus, the treatment that best achieves the social optimal output in reality is Treatment 5 (cheap talk and voting).

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[11] In Treatment 3 (cheap talk), subjects were more likely to make full contributions and less likely to make zero contributions. Voting reinforced this pattern in Treatment 5 (cheap talk and voting). In Treatment 5 (cheap talk and status quo), subjects were less likely to make full contributions and more likely to make zero contributions compared with treatment 3. Voting also reinforced this pattern in Treatment 6 (cheap talk, voting and status quo).

Chapter 5

CONCLUSION AND DISCUSSION

5.1   Study Summary

This study, based on 36 sessions of experiments run at University of Delaware, showed that contextual factors play important roles in laboratory-run public-good games. More importantly, the effects of some contextual factors change when negative framing is introduced. Unlike VCMs and public-good games used in other studies, these experiments were designed to work under negative framing. Participants were asked to make a contribution (request a refund) to avoid (cause) negative externality problem. Six treatments were employed in the experiments and attention was focused on the effect of cheap talk in the game. The results show that cheap talk can largely eliminate negative externality problems in a laboratory setting, which is consistent with previous studies.

Status quo was also studied as a contextual factor but its effect was not consistent with previous studies regarding public good. Messer et al. (2007) demonstrated that status quo can increase donations to a positively framed public good and thus improve the social welfare.

Negative framing in this study negates the effect of status quo in the experiments. In treatments without other contextual factors, status quo does not have any significant effect on contributions or on people's willingness to avoid or cause negative externalities. In treatments with contextual factors (cheap talk and/or voting) added the

results show that a status quo of social optimal led to even lower ultimate welfare levels since cooperation between group members collapsed more quickly.

5.2   Framing Effect

This experiment provided a chance to study subject behavior under negative framing and to investigate the framing effect described by Andreoni (1995) by comparing the results of this study with results from a VCM game under positive framing. Messer et al. (2007) used a similar design to test the effect of contextual factors in a public-good game (positive externality). Without contextual factors, the contribution rate under negative framing is lower than under positive framing, especially in early rounds. The first round contribution rate in this study's experiment was 39.2% compared with 47% from Messer et al. (2007). With the status quo of social optimal, the argument still holds. The first round contribution rate in this study was 45.2% compared with 69% from Messer et al. (2007). Since these results are consistent with Andreoni's research, framing does matter in a public-good game. The contribution rates in other treatments could not be compared since the effects of status quo under positive and negative framing are different.

Psychological experiments also have examined the framing effect in public-good games and provided some explanations (Dufwenberg et al., 2007). Overall, though the results of this study are generally consistent with Andreoni's (1995) conclusion regarding the framing effect, questions remain about the actual effect of framing, particularly outside the laboratory.

5.3   Implications and Discussion

The results and conclusions of this study lend some useful information to policy-makers who are attempting to eliminate or reduce externality problems and the social inequity they can cause. Cheap talk was shown to have a significant effect on contributions in public-good games with either positive or negative externality. Notably, communication has not been confined to pre-play and face-to-face talk. Other forms of communication also can increase contributions and thus the efficiency level. These include chat via computer terminals, visual communications, and round-by-round cheap talk.

The effect of status quo, on the other hand, changes when framing was changed. This might lead to the conclusion that policy-makers do not necessarily bother to "create" or induce a status quo of social optimal. People make no more and possibly less effort to eliminate or reduce negative externality problems in a laboratory setting when facing a status quo of social optimal. Future studies are required to understand why subjects behave differently based on the externality cost.

Finally, note that framing is also important when trying to solve public problems. According to Andreoni's (1995) conclusion and the results from experiments here, people prefer performing "good deeds" over avoiding "bad deeds."

As mentioned in the introduction, many environmental problems are caused by externalities and such problems often unfortunately exist under negative frames. The good news from our research, however, is that status quo does not have significant effect to promote contribution. Thus, authorities have no need to bother to change the status quo when trying to solve externality problems. Such changes are usually associated with extra cost to authorities. For example, in a pollution case, government may ask individuals to make contributions to reduce the pollution. In this process, communication can be

employed to increase contribution. However, there might be no need to make effort to change the status quo (i.e. set initial endowment in public sector) since such actions may lead to very limited or even opposite effect.

APPENDIX

A.1   Instructions

Treatment 1 (baseline)

Experiment Instructions

Welcome to an experiment in the economics of decision making. In the course of the experiment, you will have opportunities to earn money. Any money earned during this experiment is yours to keep. Please read these instructions carefully and do not communicate with any other participants during the experiment.

In today's experiment, you will participate in a number of rounds. The number of rounds has been determined prior to the start of the experiment. Throughout the experiment, you will be in a group of seven participants.

At the start of reach round, you and everyone else in your **group** will initially have $1.00 allocated to your **Account B**. Therefore, initially $7.00 has been allocated to Account B in total ($1.00 x 7 subjects). You, and everyone else in your group, will need to

Total Amount in Account B	Account B Loss
$0.00	$0.00
$0.25	$0.05
$0.50	$0.11
$0.75	$0.16
$1.00	$0.21
$1.25	$0.27
$1.50	$0.32
$1.75	$0.38
$2.00	$0.43
$2.25	$0.48
$2.50	$0.54
$2.75	$0.59
$3.00	$0.64
$3.25	$0.70
$3.50	$0.75
$3.75	$0.80
$4.00	$0.86
$4.25	$0.91
$4.50	$0.96
$4.75	$1.02
$5.00	$1.07
$5.25	$1.13
$5.50	$1.18
$5.75	$1.23
$6.00	$1.29
$6.25	$1.34
$6.50	$1.39
$6.75	$1.45
$7.00	$1.50

decide whether to give a **contribution** of this allocation by moving some or all of the $1.00 from Account B to **Account A**. For each round, three different items will determine the payoff for you and everyone else in your group:

The **Account A Payoff** is the amount of money that you contribute to Account A multiplied by 3/2 (=1.5).

The **Account B Payoff** is the amount of money that you do not give as a contribution to Account A, and thus keep in Account B, multiplied by 5/2 (=2.5).

The **Account B Loss** is the total amount of money that your group keeps in Account B multiplied by 3/14 (~0.214). The table on the right shows how the Account B Loss varies depending upon the total amount of money in Account B at the end of the round.

In summary, your earnings in each round are equal to your Account A Payoff, plus your Account B Payoff, minus the Account B Loss.

To give a contribution from Account B to Account A, enter the amount, if any, into the yellow cell in your spreadsheet, hit "Enter" on the keyboard, and then click the "Submit" button. After every participant has submitted their decision, the administrator will calculate the Account B Loss, which you can view once you are instructed to click the "Update" button.

Your earnings will be calculated automatically. You will then proceed to the next round and follow the same procedures.

At the end of the experiment, your earnings will be converted to US dollars with an exchange rate of 2. (If you make $30 in the experiment, you will get $15 US dollars)

Experiment Instructions

Welcome to an experiment in the economics of decision making. In the course of the experiment, you will have opportunities to earn money. Any money earned during this experiment is yours to keep. Please read these instructions carefully and do not communicate with any other participants during the experiment.

In today's experiment, you will participate in a number of rounds. The number of rounds has been determined prior to the start of the experiment. Throughout the experiment, you will be in a group of seven participants.

At the start of reach round, you and everyone else in your **group** will initially have $1.00 allocated to your **Account A**. Therefore, initially $7.00 has been allocated to Account A in total ($1.00 x 7 subjects). You, and everyone else in your group, will need to decide whether to request a **refund** of this allocation by moving some or all of the $1.00 from Account A to **Account B**. For each round, three different items will determine the payoff for you and everyone else in your group:

Total Amount in Account B	Account B Loss
$0.00	$0.00
$0.25	$0.05
$0.50	$0.11
$0.75	$0.16
$1.00	$0.21
$1.25	$0.27
$1.50	$0.32
$1.75	$0.38
$2.00	$0.43
$2.25	$0.48
$2.50	$0.54
$2.75	$0.59
$3.00	$0.64
$3.25	$0.70
$3.50	$0.75
$3.75	$0.80
$4.00	$0.86
$4.25	$0.91
$4.50	$0.96
$4.75	$1.02
$5.00	$1.07
$5.25	$1.13
$5.50	$1.18
$5.75	$1.23
$6.00	$1.29
$6.25	$1.34
$6.50	$1.39
$6.75	$1.45
$7.00	$1.50

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The **Account A Payoff** is the amount of money that you do not request as a refund to Account B, and thus keep in Account A, multiplied by 3/2 (=1.5).

The **Account B Payoff** is the amount of money that you request as a refund from Account A to Account B, multiplied by 5/2 (=2.5).

The **Account B Loss** is the total amount of money that your group requests as a refund from Account A to Account B multiplied by 3/14 (~0.214). The table on the right shows how the Account B Loss varies depending upon the total amount of money in Account B at the end of the round.

In summary, your earnings in each round are equal to your Account A Payoff, plus your Account B Payoff, minus the Account B Loss.

To request a refund from Account A to Account B, enter the amount, if any, into the yellow cell in your spreadsheet, hit "Enter" on the keyboard, and then click the "Submit" button. After every participant has submitted their decision, the administrator will calculate the Account B Loss, which you can view once you are instructed to click the "Update" button.

Your earnings will be calculated automatically. You will then proceed to the next round and follow the same procedures.

At the end of the experiment, your earnings will be converted to US dollars with an exchange rate of 2. (If you make $30 in the experiment, you will get $15 US dollars)

<u>Treatment 3 (Cheap Talk)</u>

(Other parts same as treatment 1)

…………………………………..

In today's experiment, you will participate in a number of rounds. The number of rounds has been determined prior to the start of the experiment. Throughout the experiment, you will be in a group of seven participants (No.1 through No.7 will be in Group 1 and No.8 through No.14 will be in Group 2). Before the experiment, you will be given **up to five minutes** to discuss your donations to the **Group Account** with other subjects in your group. This discussion is free and open, except that no deals or threats are allowed.

At the start of reach round, you and everyone else in your **group** will initially have $1.00 allocated to your **Account B.** Therefore, initially $7.00 has been allocated to Account B ($1.00 x 7 subjects). You, and everyone else in your group, will need to decide whether to give a **contribution** of this allocation by moving some or all of the $1.00 from Account B to **Account A**. For each round, three different items will determine the payoff for you and everyone else in your group:

…………………………………

(Other parts same as treatment 1)

Treatment 4 (Cheap Talk/Status Quo)

(Other parts same as treatment 2)

………………………

In today's experiment, you will participate in a number of rounds. The number of rounds has been determined prior to the start of the experiment. Throughout the experiment, you will be in a group of seven participants (No.1 through No.7 will be in Group 1 and No.8 through No.14 will be in Group 2). Before the experiment, you will be given **up to five minutes** to discuss your donations to the **Group Account** with other subjects in your group. This discussion is free and open, except that no deals or threats are allowed.

At the start of reach round, you and everyone else in your **group** will initially have $1.00 allocated to your **Account A**. Therefore, initially $7.00 has been allocated to Account A in total ($1.00 x 7 subjects). You, and everyone else in your group, will need to decide whether to request a **refund** of this allocation by moving some or all of the $1.00 from Account A to **Account B**. For each round, three different items will determine the payoff for you and everyone else in your group:

……………………….

(Other parts same as treatment 2)

Treatment 5 (Cheap Talk/Voting)

(Other parts same as treatment 1)

………………..

In today's experiment, you will participate in a number of rounds. The number of rounds has been determined prior to the start of the experiment. Throughout the experiment, you will be in a group of seven participants. First, you will have the opportunity to vote on which market rules will be used for your group for the proceeding trading periods. A **majority vote** will determine which market rules will be implemented. Your vote will be confidential and will not be shared with any other members of the experiment. Before the vote, you will be given **up to five minutes** to discuss your opinions about the vote and donations to the **Group Account** with other subjects in your group. This discussion is free and open, except that no deals or threats are allowed. After the discussion, you will select your preference in your spreadsheet and click the "Submit Vote" button. After all of the votes have been submitted, the administrators will announce the outcome. There are two possible sets of market rules:

1) *Private Lottery.* Initially, you and everyone else in you group will be given a lottery ticket in each round. At the start of each round, you will need to decide whether you would like to keep the lottery ticket or sell it. If you decide to sell the lottery ticket, you will be paid $1.00. If you keep the lottery ticket, a coin toss will determine the payoff for this lottery ticket. If the coin toss is **heads**, the payoff is $2.00. If the coin toss is **tails**, the payoff is $0.00. The coin will be provided and flipped by a volunteer subject; therefore the odds for either a heads or a tails are equal.

2) *Group Activity.* At the start of reach round, you and everyone else in your **group** will initially have $1.00 allocated to your **Account B**. Therefore, initially $7.00 has been

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allocated to Account B in total ($1.00 x 7 subjects). You, and everyone else in your group, will need to decide whether to give a **contribution** of this allocation by moving some or all of the $1.00 from Account B to **Account A**. For each round, three different items will determine the payoff for you and everyone else in your group:

………………………..

(Other parts same as treatment 1)

(Other parts same as treatment 2)

…………..

In today's experiment, you will participate in a number of rounds. The number of rounds has been determined prior to the start of the experiment. Throughout the experiment, you will be in a group of seven participants. First, you will have the opportunity to vote on which market rules will be used for your group for the proceeding trading periods. A **majority vote** will determine which market rules will be implemented. Your vote will be confidential and will not be shared with any other members of the experiment. Before the vote, you will be given **up to five minutes** to discuss your opinions about the vote and donations to the **Group Account** with other subjects in your group. This discussion is free and open, except that no deals or threats are allowed. After the discussion, you will select your preference in your spreadsheet and click the "Submit Vote" button. After all of the votes have been submitted, the administrators will announce the outcome. There are two possible sets of market rules:

1) *Private Lottery***.** Initially, you and everyone else in you group will be given a lottery ticket in each round. At the start of each round, you will need to decide whether you would like to keep the lottery ticket or sell it. If you decide to sell the lottery ticket, you will be paid \$1.00. If you keep the lottery ticket, a coin toss will determine the payoff for this lottery ticket. If the coin toss is **heads**, the payoff is \$2.00. If the coin toss is **tails**, the payoff is \$0.00. The coin will be provided and flipped by a volunteer subject; therefore the odds for either a heads or a tails are equal.

2) *Group Activity.* At the start of reach round, you and everyone else in your **group** will initially have \$1.00 allocated to your **Account A**. Therefore, initially \$7.00 has been

allocated to Account A in total ($1.00 x 7 subjects). You, and everyone else in your group, will need to decide whether to request a **refund** of this allocation by moving some or all of the $1.00 from Account A to **Account B**. For each round, three different items will determine the payoff for you and everyone else in your group:

…………..

(Other parts same as treatment 2)

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